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## Digital Literacies for International Teacher Education: a Ghanaian perspective

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The Open  
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Dissertation for the award of  
Master of Research (Education)  
The Open University

*Digital Literacies for International Teacher  
Education: a Ghanaian perspective*

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## **Abstract**

Teacher education in Sub Saharan Africa has been highlighted as key in helping to ensure inclusive and equitable quality education across the continent. Digital technologies that support new modes of teacher education can improve access and quality in developing regions (Moon and Villet, 2017a, b; Moon, 2007; Power, 2013), however little is known about how teachers develop digital literacies to enable them to effectively use these new resources, nor the ways in which student teachers are introduced to the technologies they need to support their professional development.

Given the scarcity of research in this area and with teacher support and preparation having been the least examined topics in mobile learning research, this project investigated the ways in which student teachers in one College of Education in Ghana participate in learning experiences that develop their digital literacies to support their professional development throughout the college course, both on campus and in school placements.

Using ethnographic approaches within a sociocultural theoretical rationale, the aim of this research was to address the gap in literature by examining the ways in which student teachers participate in learning experiences that develop their digital literacies during their training at a College of Education in Ghana.

In view of the slow pace of ICT infrastructure advancement in Ghanaian schools, tutors at one college of education are encouraging the use of student teachers' personal devices such as mobile phones to support their professional learning, both on campus and in the absence of other equipment in school placements. Smartphone use was found to be an enabling tool for students, whose formal and informal use of communication tools such as WhatsApp supported their developing professionalism

and gave them access to new ways to locate and use materials for teaching and their wider professional development, including the academic requirements of their courses.

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## **Chapter 1: Aims and objectives**

### **1.1 Introduction and rationale**

This chapter sets out the context, aims and objectives of this study, providing a rationale for the decision to undertake research within the field of teacher education in Sub Saharan Africa (SSA), and specifically Ghana. This research sits within a body of work aiming to improve the training of teachers in developing countries. The specific contribution of this study is to explore the ways in which student teachers develop skills to effectively access, use and apply online materials to support their professional development and classroom practice.

There are two dimensions to the teacher education challenge: global teacher shortages in a context of growing pupil enrolment in several SSA countries and the need for quality classroom teachers trained to meet their learners' needs in challenging, low resource contexts. One way in which teacher educators are addressing these issues is through the development of digital learning programmes and resources to help teachers pre and in-service become more effective. This research aims to investigate how and in what ways trainee teachers are being given opportunities to develop the digital literacies necessary to fully participate in these opportunities and how they then use them throughout their initial teacher training (ITT).

### **1.2 Education statistics for Sub Saharan Africa and the context for SDG4**

The Universal Declaration of Human Rights and the United Convention of the Rights of the Child (UNCRC) state that all children have the right to a free primary education (UN 1948; 1989). In reality, schooling is not available to all. Despite an increase in primary school enrolment to 91% of children in developing nations since the



introduction of the Millennium Development Goals (MDGs), in 2015 264 million children and youths were out of school globally with Sub-Saharan Africa the region with the highest proportion for all age groups. Of the 61 million out of school primary children worldwide, more than half of these, 33 million, live in this region (GPE, 2017).

2015 saw the end of the MDGs and the introduction of the Sustainable Development Goals (SDGs) which focus on quality education as well as enrolment. SDG4 aims to ensure inclusive and quality education for all learners with a specific goal by 2030 to *'substantially increase the supply of qualified teachers, including through international cooperation, for teacher training in developing countries, especially least developed countries'* (SDG4.c, United Nations, 2015). The goals recognise the need to overcome the global challenge of teacher recruitment to meet growing demand and the issue of quality in education so that children are able to progress to the next stage of their education, improve their life chances and help prevent further cycles of poverty.

### **1.3 The teacher recruitment crisis**

Central to meeting the growing demand for school places in SSA is to ensure that there are enough trained teachers to fill the gaps and that they are adequately prepared to teach. In terms of teacher supply, the shortage of qualified teachers who must be recruited for Sub-Saharan Africa alone is over 17 million to achieve universal primary and secondary education by 2030, the largest shortfall in the world according to the United Nations (2015). Although primary enrolment and teacher recruitment has increased, teachers do not always meet the national minimum qualifications and training standards to teach, thus adding a further layer to the complexity of the situation (UNESCO 2016, p11). This impacts on learners because in addition to the millions of children missing school, many who do attend are not learning the basics and being failed by a system that results in poor learning outcomes (Bennell and Akyeampong, 2007; UNESCO, 2013/14; UNESCO, 2016). In research across seven SSA countries

covering 40% of the population, research by the Institute for International Economic Studies (IIES) and World Bank report that after three years of public primary schooling, many pupils lack even the most basic skills (quoted in Moon and Villet, 2017a, p25). A lack of quality education is a similar situation as having no education at all.

The issue of teacher quality is most often addressed through teacher training and professional development, both pre and in-service. In order to meet the teacher shortage and to address issues of quality, it is vital that well trained teachers are entering the system to meet the rising demand and replace those lost through attrition, retirement or sickness, particularly in this region where in addition to the challenges of poverty, health epidemics have impacted education and wider society. More trained teachers could also reduce large class sizes if children have access to them.

#### **1.4 Digital learning in teacher education**

Given the challenge of supply and the scale of need, it has been argued that new forms of teacher education are necessary for the twenty first century to train and equip those in service with the skills to be more effective (Moon and Villet, 2017a, b; Moon, 2007; Power, 2013).

Ghana has historically favoured conventional full-time training in colleges of education (CoE), e.g. three year courses consisting of two years in college and one in school, the 'in-in-out' model, although other sandwich models exist. Digital technologies that support new modes of at-scale distance learning could help resolve this supply crisis (Moon and Villet, 2017a, b; Moon, 2007; Power, 2013) and large-scale online projects have been initiated to support access and quality in teacher education in developing regions (TESSA, TESS India 2017). This is the position being taken in this study.

Whilst much has already been written about a lack of infrastructure that blights development in many communities, more human aspects such as evidence of teacher's digital competencies or literacies to allow them to access such online digital professional development materials has been more difficult to source. In particular, evidence in an African context on how mobile phones can enhance and support teachers' professional development is sparse (Bass-Fimmons and Kinuthia, 2015, p2).

### **1.5 Personal Rationale**

As well as the challenges for teacher education in Ghana highlighted above, there were personal motivations behind this research which are important to share as a reflexive researcher, motivated to be transparent in all stages of the research process.

The opportunity to develop global learning and international school partnerships whilst teaching in a London primary school in the latter part of the last decade enabled me to initiate and set up a DFID school partnership with a rural Ghanaian school, which supported the development of joint school projects and whole school learning about development issues. This partnership and the resulting reciprocal staff exchange visits allowed me to see first-hand the scale of challenge for small, rural schools and the staff working in them. Working in extremely resource limited environments, teachers spoke about the limited opportunities afforded them which they believed was due to their status as a small rural community at great distance from the capital city Accra, where they assumed training and development opportunities might exist for others in education. Exchanging staff and curriculum ideas enabled teachers on both sides of the partnership to think critically about what constituted good teaching and learning and technology was used to facilitate some of these exchanges, for example, Ghanaian students visited an internet café to Skype the London school. Given the

tight time frame for this research and drawing on my interest in and prior knowledge of the country, Ghana was selected as an appropriate place to find a site for the enquiry as I wanted to go beyond the informal insights gained into conducting more targeted research into the provision of teacher training and the possibilities that digital literacies might afford teachers.

Alongside this, sharing a professional background with teacher educators enabled open conversations that had a number of advantages, in terms of the shared experiences of education, such as shared pressures from policy makers and governments, and the shared language and jargon used in education settings. It also appeared to be the case that my professional background as a teacher turned researcher may have helped act as a leveller, as sharing some autobiographical details helped participants understand my familiarity with some aspects of their teacher training experiences, albeit in a very different contexts.

It is within this broad and challenging context that a focus on teacher development as an area of importance sits and is why the theme and the country was chosen. Given the debates about digital resources contributing to better quality teaching or teacher training, this study will explore how teachers develop their digital literacies throughout their teacher training programme as a means of understanding this one aspect of that complex broader aim. Derived from a review of the current literature, the research question for this study is: *In what ways are student teachers in Ghana participating in learning experiences that develop their digital literacies to support their professional development?*

## **Chapter 2 Literature Review**

### **2.1 Introduction**

This review of the literature will build on the introductory chapter by surveying what is already known about teacher development and digital literacies in less economically developed contexts, with the purpose of refining research questions for the study. It was the researcher's intention to include as many diverse voices and perspectives as possible within the limited scope of this dissertation, to represent broad scholarship from a range of academics, including where possible African scholars.

### **2.2 Teacher education and digital literacies context**

If twentieth century training methods will neither close the gap on numbers or quality for the world's poorest, then digital technology programmes for teacher professional development (TPD) could provide teachers in both initial teacher training (ITT) and in-service with accessible opportunities to help them teach more effectively. Moon and Villet (2017a, p32) explore the possibilities that teacher education planning and policy will be in a position to exploit these new modes of digital accessibility in the future and suggest a phased timeline of possible actions over the years 2016-2020 and onwards. Data collection was mapped against their three-phase approach and is discussed in Chapter 5.

These developments can allow student teachers to be able to see and experience the kinds of pedagogical innovations often described to them in theoretical terms, but to which they have little experiential access. This could be through innovative and collaborative teaching methods being modelled and demonstrated in teacher colleges so that they themselves experience this in familiar contexts (Akyeampong et al, 2013).

As well as first-hand experiences, and for some this will be their only means to access such learning, digital resources such as video clips or other accessible formats can provide new pedagogical possibilities by allowing teachers to gain familiarity with alternative teaching methods that engage pupils in their learning. But to access such materials it is necessary for teachers to possess the digital skills to engage with the tools to fully utilise such learning, and relevant materials for their needs and contexts (accessibility); as well as the physical means, in terms of infrastructure, connectivity and affordability, and so on (access). Such digital developments in teacher education could contribute to the teacher crisis in multiple ways:

- i. by reaching more teachers in greater numbers than traditional, face to face forms of training, for example through MOOCs or Open Educational Resources (OER);
- ii. by enabling access for those teachers who find attendance at traditional training sessions difficult, e.g. teachers in remote or rural areas for whom travelling is difficult; or teachers whose gendered or cultural roles prevent them travelling away from their homes and schools, especially overnight;
- iii. for cost effectiveness- online materials require a device and an internet connection at points, but can avoid other costs associated with face to face methods such as travel, accommodation and subsistence;
- iv. by contributing to new ways of supporting teachers, for example through peer support, remote supervision, or enhanced access to course work or materials;
- v. by providing opportunities to find, use and adapt learning materials and resources for the classroom in a national or global context;
- vi. by providing the opportunity to see and experience different pedagogies, not just theories; for example, materials that encourage interactive and reflective practice within similar challenging contexts, e.g. videos showing classroom teachers trialling new teaching methods;

- vii. by connecting teachers with an online community of practitioners, and opening up opportunities for seeing and trying new practices, sharing materials and learning from one another, not simply a one-way tutor to student transmission model.

Evidence for iv. to vii. was examined in this study and discussed in Chapters 4-6. Digital literacies or technologies can be a tool for teachers through which they develop new skills but are not seen here as the solution to the significant global challenges in education. For this reason, the literature review takes a critical approach and is revisited in Chapters 4 and 5 after data collection to reflect on how theory and practice in one setting align.

### **2.3 Teacher education in Ghana**

The regional concerns about quality and learning outcomes for children in SSA are also true for Ghana. The Government published statistics showing that proficiency in literacy and numeracy at Basic Education level (primary schools) is of serious concern as since 2002 there have been no significant improvements in quality (MoE 2013, p9). These concerns give rise to debate about the quality of teaching children receive and how teachers are prepared to meet the challenges.

Asare and Nti (2014) synthesize what is known about teacher professional development in Ghana through a systematic literature review that outlines how primary teachers are trained through CoEs, generally the pre-service three-year Diploma in Basic Education (DBE). They describe a scenario where teachers teach the way they were exposed to teaching, which places great importance on teacher tutors' methods of instruction. Lewin and Stuart note that the 'dominant pedagogical stance remains one where trainees are largely regarded as empty vessels, with little knowledge experience of teaching' (Lewin and Stuart, 2003, p171), and recommend that new

teachers should be treated as professionals in training, equipped with the kinds of critical thinking skills necessary for them to teach in the most challenging contexts. Exploring initial teacher education in five countries including Ghana, they found that:

*“many tutors have surprisingly little detailed knowledge of the characteristics of the students they train, or of the school environments that newly trained teachers enter. Sometimes the colleges appear to be training students for schools as tutors think they ought to be, rather than for schools as they are”* (p698).

Akyeampong et al. (2013) and Akyeampong (2017) are relevant, contemporary papers identified as important for this study because of Akyeampong's broad research in education issues, in particular teacher education across Africa and the Ghanaian context where there are few empirical studies in this field, and also his influence on Ghanaian national education policy.

There limitations of the 2013 paper is that it relies on the Teacher Preparation in Africa (TPA) Project study report for Ghana (Adu-Yeboah, 2011), whose research design examined teaching methodology through focus groups of 8 students per college after lesson observations of tutor teaching (p12) and aimed to measure teacher practice through the administration of a closed question survey, which allowed no space for discussion or demonstration of real world teaching in context (p14), acknowledged that 'respondents seemed to have forgotten what they had learnt in the courses' and which asked trainees to participate in a re-enactments of the lessons researchers wanted to observe, which they declined.

Akyeampong's 2017 paper reports qualitative data from a research project (Teacher Preparation in Africa, TPA) which explores eight teacher educators' practice and vision of good teaching of primary mathematics. This study is useful for learning about primary teacher education in mathematics although the numbers of participants and



range of sites will not necessarily be representative of teacher education for Ghanaian tutors in colleges of education. However, the findings that tutors favour the use of teaching and learning materials (TLMs) and small group activities was apparent in this study, although instructors did give varied and frequent advice about low resource classroom contexts, e.g. by advocating mobile phone use (p197).

Akyeampong et al (2013) found that the most significant impact on teachers is what is learnt in pre-service training, which they say validates a belief in the primacy of these institutions and their teaching, fostering a belief that there is a 'correct' or 'proper' way to teach and that once mastered, this can be 'delivered' in any context (p274). This, they argue, sets students up for failure as they are led to think that they are more competent than they actually are. In effect, they have been taught how to perform or behave as teachers, but not necessarily how learners learn.

Akyeampong et al. (2013) used mixed methods to analyse teacher education in several African countries including Ghana and therefore their results synthesize multiple sites of four colleges per country. Although questionnaire data and numbers are included, the numbers of participants interviewed for qualitative purposes through in-depth interviews or focus groups require the reader to go to earlier country based reports (for Ghana, Adu-Yeboah, 2011). In addition, given the focus on ITT experience which includes school placements or 'practicum', the study did not appear to cover this aspect as only Year 2 students and NQTs were interviewed in the Ghanaian context (Adu-Yeboah, 2011).

Despite an emphasis on pre-service experience, they also found that newly trained teachers *"may learn to conform to the very local class and school environment, hierarchies and practices in use, which may 'wash-out' the impact of their training, despite the authoritative confirmation of a correct way of teaching by their college education"* (p275).

Asare and Nti support this idea and note that even when new teachers are introduced to new and innovative practices, initially *'bursting with enthusiasm to apply the new approaches and strategies to promoting effective teaching and learning, they rather copy the ineffective practices of the long-serving teachers, becoming ineffective themselves over time'* (Asare and Nti 2014, p8). There appears to be a tension in what is taught in college and what happens in school, with the implication that newly qualified teachers either 'fall back' on teaching methods modelled in their own formative school years, or they adapt and begin to use the methods seen or learnt in their new schools.

Progress can be further hampered by an assessment regime that assesses trainees' progress in subject content knowledge and not on the application of this knowledge in a classroom environment (Akyeampong et al, 2013). In addition, the use of simulation teaching activities, where student teachers teach lessons to one another in 'on campus teaching practice' (OCTP) sessions with trainee teachers in the role of children, do not prepare trainees for the kind of responses and challenges real children are likely to face. These simulation lessons they argue idealise children's responses and fail to reflect the reality of many poor childrens' backgrounds, whose lives are disadvantaged by the realities of poverty. Teachers, they state, are not led to understand teaching as a process but rather as a series of actions or procedures that once carried out appropriately, would result in pupil learning in any classroom (Akyeampong et al, 2013 p281).

As well as tensions in training provision, the school environment can be challenging even before a lesson is taught. Any accommodation provided might be sub-standard, journeys to school may be long, often walked on foot and hampered by inaccessible roads during poor weather. School buildings are sometimes dilapidated and many are

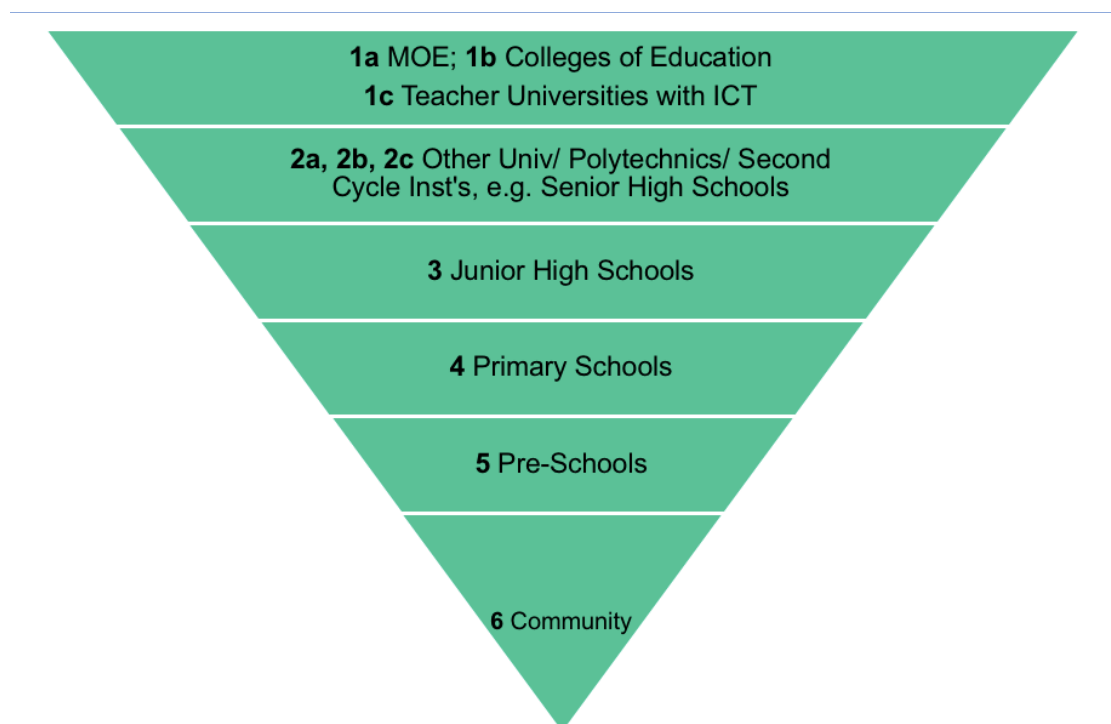
overcrowded, without basic school furniture and equipment, particularly for ICT. Text books can be shared between several pupils. Teachers pay is considered low and is often paid late. As a result of this, teacher absenteeism is an issue and motivation and morale is low for many (Buckler 2015, Moon and Villet, 2017a, b). The implications of these challenges for student teachers could be that they are unable to use and practice the digital literacies they have developed in college.

## **2.4 Ghana's policy on ICT in education**

The Ghanaian Ministry of Education seeks to modernise the educational system and the suggestion is that technologies have an important part to play. They aim *'through ICTs to improve the quality of education and training at all levels, thereby expanding access to education, training (in particular teacher professional development) and research resources and facilities'* (Government of Ghana, 2013, p16). The school curriculum includes ICT at all levels and the general aims of ICT for primary grades 1-6 and Junior High Schools (JHS) are progressional, mostly designed to help pupils acquire basic ICT literacy and internet skills, and to be able to communicate effectively using ICT tools (Government of Ghana, 2015, p28). They highlight the value for teachers and students in accessing *'international knowledge networks and shared educational resources'*, noting and recognising a number of issues in the system pertinent to this study (p15/16) which include:

- a lack of policy direction at all levels for the integration of ICT in education;
  - Low levels of ownership and of understanding at a school level about the potentials of ICTs in education, and
  - A lack of trained ICT personnel, including teachers, to support the initiatives
- (P18-19)

In recognition of the need to prioritise resources, they propose a hierarchy within which ICT infrastructure is rolled out, with Colleges of Education being singled out as top priority just after the Ministry and its agencies, and with subsequent phases of education being included in age related priority in an approach that favours early adoption for institutions of older students and progression down the age range with community facilities last to be included. From this we can assume that older students are prioritised over younger pupils, reasons given include capacity building for teachers over others and proximity of educational institutions to the job market (p22/23).



*Adapted from Government of Ghana, 2015, p23*

No timeframes are indicated in this proposal and the linear nature might mean that teacher training prepares students for a classroom that in reality has no ICT infrastructure, especially for younger learners, supported by this study's findings. Deprioritising the community may also be problematic: a community resource could in

theory be used by everyone and schools could be the hub that accommodates them. Likewise, entrepreneurial internet cafés might work with communities and schools for mutual advantage.

## **2.5 Digital teacher education programmes**

There have been some examples of Ghanaian CoEs and universities with teacher education programmes being involved in innovative digital teacher programmes. TESSA provides a bank of OER adapted for Ghanaian contexts by local education experts to support teachers and teacher educators in developing active approaches to learning (TESSA, 2017). Several other programmes also exist across the SSA region utilising technologies and resources to increase teacher's knowledge and skills and to support the development of learner centred pedagogies (ATEN, 2014; Moon and Villet a, b, 2017; ROER4D, 2017;). Several strategies to improve teacher learning have been identified: OER and MOOCs for professional development are two such examples.

As these digital resources and projects have been highlighted as an area to prioritise, it is necessary to define what is meant by the loose terms 'digital literacies' or 'digital learning'. Examples given above represent how digital developments could respond to the teacher education crises. However, to enable teachers to participate in these kinds of opportunities, they need the relevant skills to engage and CoEs are key in teaching such skills. In addition, support for utilising social media and social networks for professional development might also provide opportunities through informal learning which can be used to develop appropriate skills and competencies. The next section attempts to review a few key understandings of digital literacies in the literature.

## 2.6 Digital literacies

The notion of digital literacy appears to be contested and the language used to describe such skills, attributes or competences is somewhat confusing. In a sweep of the literature carried out by Ilomäki et al (2016, p655), they summarise digital literacy as singular or multiple, a set of skills and/ or competences, or as different terms altogether, such as digital learning. This study is significant because it aims to synthesize academic scholarship to ascertain what the term 'digital competence' means, fundamental to understanding for this study.

This research is less robust when we consider the selection criteria and range of sources. Within the analysis of educational research articles, out of a potential 272 only 76 were selected using only two electronic databases (p655). This may have excluded non-US/European papers, including those in other languages than English; all those papers outside the date range 2005- 2013, thus omitting more recent scholarship; and of relevance for this study, excluding 21 papers on teacher education, as part of their sift of first results (p660-1).

The authors' synthesis suggests an overlap between digital learning and mobile learning, digital skills and the phrase more commonly used in earlier frameworks, ICT competencies. They also note that digital literacy/literacies are the most used phrase to define the broad area of digital competencies or skills, but despite this, they continue to use the term 'digital competences' (p633). A reason for the confusion or absence of definitions they suggest is that only a few studies have ever focussed on measuring this phenomena (p644). They suggest that digital competence is defined as a combination of

- I. technical competence
- II. ability to use digital technologies in a meaningful way

- III. ability to evaluate digital technologies critically
- IV. motivation to participate in the digital culture.

They suggest that the term 'digital literacies' has replaced ICT when talking about technology-related skills (p658) and argue that narrow definitions can actually limit the capture of the breadth and scale of new technologies and become redundant in a rapidly evolving context (p671); that digital competence is evolving and in educational research is not yet standardised, suggesting that it is a useful '*boundary concept*'. Given the arguments above and the number of conceptualisations, 'digital literacies' is the term being used in this dissertation, with a caveat on this terminology as language choices can be problematic by privileging one point of view over others. This is particularly pertinent in developing contexts because research is heavily skewed by that which originates in the northern hemisphere and literature on digital literacies in a development context was difficult to source.

For this dissertation study, the researcher aimed to use the language most appropriate to participants in the research setting to avoid imposing preconceived words and definitions, so the term 'digital literacies' is a fluid one. In comparing different interpretations of digital literacies, it is useful to situate ideas within a framework. For this review, two frameworks were considered although there are none that explicitly focus on digital literacies within an African context. The two frameworks under scrutiny for this project are the UK Literacy Working Group (LWG) Approaches to Literacy (Eldred et al., 2007) and UNESCO's ICT competency framework for teachers (UNESCO, 2011).

## **2.7 UK Literacy Working Group (LWG) approaches to literacy**

The LWG framework identifies three approaches to adult literacy within a development context. The original framework focuses on text-based literacies but provides a foundation on which to build an additional 'layer' for digital literacies, more relevant than based on assumptions of wealthier regions. The authors identify and compare these three approaches: a functional approach which focusses on literacy being a necessity for economic benefits and development; a transformative approach, more political and radical, challenging the former neo-liberal, economic approach; and a socially situated approach, where literacy is seen as a social practice, acquired in formal and informal ways as part of society, and taking an alternative view than the literate/non-literate dichotomy (Eldred et al., 2007, p7). The third approach is the model the authors and the researcher suggest is most appropriate in examining literacy practices in development contexts as it rejects the dominant 'functional' approach and stresses the impact of social context on the development and use of literacy skills. The framework can be used to consider the different interpretations of digital literacies, building on the original.

## **2.8 UNESCO Framework for teacher ICT competencies**

UNESCO created an international benchmark which set out the competencies required to teach effectively with ICT. Although slightly dated, it provides an additional structure to examine student teachers' digital literacies or competences. UNESCO's framework appears to align with the functional model as it aims to '*connect education policy with economic development*' (UNESCO 2011, p7) and support teachers to help students learn through ICT to become '*effective citizens and members of the workforce*'(p3). Ilomäki et al's review of digital literacy definitions also mentions this emphasis on



economic competition rather than more critical active citizenship (p658).

The Framework addresses three different approaches they suggest are successive stages of a teacher's development and is intended to support policy makers, teacher educators and others working with teachers on the role of ICT in educational reform in no specific geographical context (p3). The three progressive strands from Technology Literacy to Knowledge Creation references Digital Literacy within TPD as a priority, with the implication of its primacy.

	TECHNOLOGY LITERACY	KNOWLEDGE DEEPENING	KNOWLEDGE CREATION
TEACHER PROFESSIONAL LEARNING	Digital literacy	Manage and guide	Teacher as model learner

*Adapted from UNESCO (2011, p3)*

The framework identifies possible barriers to technology use including teacher knowledge (p4) and identifies specific skills teachers must acquire, including basic computer use, tools, software and the internet (p23). Edumadze (2016) evaluated the extent of ICT integration in Ghana's CoEs based on the UNESCO framework, examining ICT tutors' perceptions of the ICT curriculum and student capability to teach ICT in Basic schools. All except one college self-assessed as 'emerging' on a continuum of emerging, applying, infusing or transforming. Other challenges included inadequate ICT infrastructure, a very low ratio of ICT tutors to students and a lack of ICT integration into the ITT curriculum.

## **2.9 Mobile phones in Ghana**

Given the context of this study, a female college of teacher education, a reflection on the availability and use of the internet and mobile technologies for women can highlight any issues or dispel myths about availability or competencies. Hilbert highlights women

being more active users of digital tools and embrace mobile telephony more than men (2010).

Rashid found very little difference between men and women in terms of ICT skills in a pan global study (2016). In Ghana, internet use for men and women is on an equal footing yet mobile telephony is more embraced by women, despite being 'more likely to be digitally excluded as a woman despite controlling for all other factors' (2016). This challenges a commonly held assumption in the discourse on technology and gender that compared to men, women are more likely to be lacking in digital competencies. The findings were that there was very little difference between men and women in terms of ICT skills, with the exception of Bangladesh (p326).

## **2.10 Summary and conclusion**

From the limited literature reviewed for this research project, the dominant thinking appears to be in the functional domain. However, taking a socio-cultural approach can help to understand the context of teacher development so is ideal for building understanding. Development of such skills in a situation where both access and accessibility is optimum avoids further obstructing the potential for those most in most need who might benefit from such opportunities. Furthermore, inadequate digital literacies based on a set of ICT skills they work methodically through like a checklist can limit teachers to merely adopting materials rather than adapting and critically engaging with them, so that they are tailored to meet their learners' needs (Harley and Barasa, 2012).

To summarise it is useful to reiterate why this area of research is important and how it can be carried out. Given the many challenges described above, it would be pertinent to investigate how and in what ways student teachers are introduced to and develop

digital literacies to support their professional development, especially given the scarcity of research in this area (Bass-Fimmons and Kinuthia, 2015, p2). Given the slow pace of ICT infrastructure advancement, teachers may well resort to using personal devices such as mobile phones to support their teaching in the absence of other equipment. Teacher support and teacher preparation have been the least examined topics in mobile learning research (p3) and given the challenges, student teachers use of mobile devices in teacher college would be a new area to examine how they might be enabling tools of professional development. In Chapter 4, a research proposal will explain how data collection is being planned that allows these areas to be investigated at the teacher college level, building on the need for future studies to focus on '*an analysis of mobile learning initiatives that focus on professional development and teacher training within the context of Africa*' (p3). Using field based ethnographic approaches to interviewing student teachers and tutors, the following re-framed research questions will be asked: *In what ways are student teachers participating in learning experiences that develop their digital literacies during their training at colleges of education in Ghana?*

## **Chapter 3 Methods of data collection**

### **3.1 Introduction**

The literature review demonstrated that there is little research in the area of digital literacies in an African context and that which does exist does not examine student teachers' daily experiences of teacher training in which they might be developing such competences.

This chapter presents and explains the methodology, research methods and data instruments used in the data collection process to explore the ways in which student

teachers participate in learning experiences that develop their digital literacies and ends with an overview of the ethical considerations for the whole research project.

### **3.2 Research methodology**

This study takes a socio-cultural approach to researching student teacher's lived experiences in colleges of education in the campus and school-based years. This approach recognises that learners bring their own set of resources to a learning situation, for example their home languages spoken within an English-speaking education system. Learners engage in social practices and meaning is made through interaction with others. If learning is a social process, then to what extent are students given opportunities to develop these skills in teacher training environments individually and collaboratively? Are there learning opportunities that are unplanned and informal, as well as those provided as part of the formal curriculum? And to what extent are these skills and competences further used and developed when students are on teaching practice placements? Taking a socio-cultural approach requires more extended interactions with participants in order to understand what is made available for them in college and in school placements and to understand how they have participated in these practices. This recognises the value of different learning contexts including historical contexts; students' funds of knowledge and how they are recognised and valued as resources for learning (Lave, 2008). This is particularly relevant for student teachers learning and practicing new skills within complex social situations. Face to face semi-structured interviews can facilitate these approaches by establishing rapport, enabling conversations about experiences across settings and time, help overcome any language barriers and assist in building trust in a way other more remote methods cannot. These are the reasons why interviews were selected as the main instruments to collect data.

This research is situated within a sociocultural framework and this has framed the choice of an ethnographic approach to data collection for this study, using multi-method qualitative instruments such as interviews, observations and field notes.

Rogoff (1995) is an influential scholar who researched within an ethnographic context. She talks about guided participation and the concept of apprenticeship which resonated with this study. In the context of learning to be a teacher and becoming part of a community of teachers, Rogoff's ideas can be expanded to include not just the acquisition of teaching skills but a change in identity: 'becoming' a teacher. If following Vygotsky we believe that all human activities, and in this case all learning activities, take place in cultural contexts (John-Steiner and Mahn, 1996, p191,) a sociocultural approach to learning how student teachers gain these skills and 'become' teachers is best understood when we consider the special context of a teacher college and in the final year, the schools in which students are placed and their communities of practice. Taking a sociocultural approach will then guide the questions asked, the approach taken, the instruments chosen and the process of analysis. A sociocultural view of learning is one where all learning occurs through interactions with others, through participation in social activities and it is through these interactions that individual meanings are understood (Open University 2007, p.35). Within a sociocultural approach, *'knowledge becomes a matter of competence in relation to valued social enterprises and knowing is demonstrated in participating in their pursuit'* (p 38). Therefore within this research, competence with ICT in relation to development as a teacher would be demonstrated through participating in teaching and learning experiences in both college and school, as well as more informal contexts according to valued ways of teaching. There may be differences in what is available to the learner to learn in either place, and a sociocultural approach assumes that communities of practice such as these might have unconscious values or rules for success. If these

norms are subconscious and shared within a community of practice, it will be necessary as an 'outsider' researcher to attempt to draw out these shared understandings through planned opportunities such as group interactions and participation in collective tasks to find a shared 'distributed cognition' (Open University 2007, p38). This is the premise taken and the reason why a focus group method was also employed as one instrument to examine learning across a variety of settings within a broader teacher education system, using an interactive activity as the stimulus for delving into these shared understandings.

One way of considering a sociocultural approach in this research might be to situate learning within the networks of relationships and experiences where learning takes place:

- Student teacher colleagues
- College Tutors
- School Based Mentors and the wider school community

taking into account participation in learning experiences on campus, in schools, and more widely, e.g. self organised study and how this participation is influenced by wider systemic issues: policy, curriculum, other 'norms'. The choice of research instruments is then driven by the type of data needed to investigate what is possible for students to participate in within these settings. The table below shows which instruments were chosen to collect key data about the social order of this context.

	Student Interviews	Tutor Interviews	Focus Group	Field notes	Lesson Observations	Document Analysis
National Level: Gov't National Curriculum and Policy		✓		✓		✓
Institutional Level: College Curriculum & Policy; Assessment	✓	✓	✓	✓	✓	✓
School Level		✓	✓			✓

*Table A: Research Instruments used for data collection showing social order of this college context*

### 3.3 Identification and rejection of research instruments

This study does not seek to situate any research methods in hierarchies but to suggest what is suitable and most appropriate to answer the research question within the methodological framework. Collecting qualitative data within an ethnographic approach will provide rich, deep description about students' lived experiences and how they perceive their professional lives, in keeping with a sociocultural tradition. Breadth and depth of student experience is achieved by using a range of methods, and in particular, in depth interviews and a focus group to explore the lives and experiences of these student teachers. A quantitative positivist approach would not be suitable, as it is difficult to measure concepts like teachers' social and learning experiences with any measure of reliability or validity, nor can people be reduced to variables (Hammersley, 2007).

Although an ethnographic approach is not without its limitations, it is argued that for this study it is suitable for context and subject matter. Careful attention to avoid the pitfalls described by Cohen et al (2011 p188-190), who consider this kind of research as potentially problematical in education, were taken and some examples follow. They argue that one must avoid 'focusing on the *familiar*' to avoid participants and researcher being so close to the situation that certain aspects might be neglected or missed. This is particularly true where the researcher shares a professional background with the participants, so a high degree of awareness and reflexivity is necessary to ensure that whilst the researcher is familiar with a professional setting or situation, they remain cautious to avoid glossing over the familiar mistakenly and being mindful to 'make the familiar strange' in both recording and presenting the data (Cohen et al, 2011 p189), as well as considering the cultural and educational contexts in which the college and its staff and students operate.

In addition, the researcher was also aware that what seemed obvious to the participants- the reasons why things are as they are- might appear quite different to the researcher, building on the reflexivity discussed earlier. One such example was the formal timetabling and uniform dress seen at the college. This must be seen within Ghana's cultural context however, as whilst uniforms are no longer mandatory for Ghanaian student teachers, this college appears to value their provision. Uniform dresses are included within the college fees as both an expression of belonging and pride in the institution, recognising that it is also a valued additional support system for young female teachers whose financial backgrounds might mean that they would struggle to provide such clothing themselves, in a country and profession which values high standards of professional attire.

An alternative approach, and one which was rejected for this study, is quantitative data collection, useful to generate numerical data, for example surveys which can also be analysed quickly. Other strengths are that they can provide reliable, generalisable



results if the samples are statistically valid and take random samples. Such methods are useful for international programmes aiming to compare cross country data, for example. The limitations of such an approach, and the reason why not chosen in this instance, is because surveys have limited ability to probe answers or expand on meanings. Surveys can be more challenging than a face to face conversation within a shared context. It could not have been assumed that student teachers would have been as comfortable expressing themselves in written English rather than in informal interviews, despite English being the medium of instruction. Face to face interviews allow for additional hints and prompts to support understanding and follow up any unexpected points arising. Surveys are also fixed in that they are pre-structured in order to guide responses and to provide a count whereas this research does not require numerical data but a description of 'how' and 'in what ways' students are learning. Using qualitative approaches are consistent with my position as they can gather in-depth data from participants to talk about their personal experiences within the context of teacher training. Working within the methodological framework, in-depth, semi-structured interviews and a focus group will be the main data collected, supplemented with ethnographic observations and field notes. Although transcripts were the main source of data, field notes were also used combined with other qualitative methods as they provide additional valuable sources of data, for example are useful to describe classroom settings and background context. Notes taken aimed to represent as closely as possible concrete descriptions of what people did and said as records of observations made. In terms of reflexivity, it is acknowledged that field notes are necessarily selective, possibly recording what is significant to the researcher, whose background as a primary teacher and teacher trainer is expected to have affected what was seen and understood. For this reason, it is advisable to include as much information as possible because it might turn out that what seems at first unimportant later takes on new meaning and relevance.

In conclusion, taking an ethnographic approach to this research question fits within a socio-cultural methodology and will draw out the kinds of practices taking place in college and school placement and how students are putting into practice the skills they have learnt within the possibilities offered by the setting. This will give a more informed set of responses than would come from a more remote experimental or quantitative approach. The data collection was carried out in a two-stage process to allow reflection time between the initial extended and follow up interviews.

Several methods were employed to collect different kinds of data allowing for triangulation. Student and tutor narratives were collected through interviews and a focus group. Lesson observations, field notes and reviews of national and college policy and documentation, where available, were also reviewed, e.g. examination papers to better understand the social order being taken up at an institutional level, which influences the learning opportunities made available to students in the college.

### **3.4 Pilot testing**

It was imperative to test the instruments and the equipment before entering the field as a learning process to familiarise the researcher with equipment, methods and questions in order to improve data quality and reduce risk. The pilots consisted of an individual interview with a West African educator and a focus group of five UK teachers. The individual interview provided valuable feedback on language choice, difficulties Ilomäki et al. recognise in the literature. This activity suggested that the term 'digital literacies' was problematic as there was no shared understanding what this meant. Interview questions were adjusted accordingly to recognise that more context-appropriate language, familiar to students and tutors would be more appropriate. Terminology is discussed more in Chapters 2, 4 and 5.

### **3.5 Process of data collection**

An interview and observation schedule followed this plan:

#### **Stage One**

Consent forms and information sheets were shared with all participants as described in the HREC process (Appendices D and E).

- In-depth semi-structured interviews with six Year 2 students discussed their skills and competencies with technology, using the opened ended questions in Appendix A
- In-depth Interviews with three ICT tutors- the entire department- provided background information from a teaching and curriculum perspective and how they support students to develop ICT and technology skills in their training experience, using open-ended questions in Appendix B
- A Focus Group of five Year 3 students were interviewed together to provide evidence of how they are developing and using digital literacies in their off-campus year, using interview questions and a group activity in Appendix C to allow them to rank and justify a set of statements about what constitutes 'good' classroom resources to encourage them to discuss the different learning opportunities and possibilities provided to them in their respective primary schools
- Parts of two ICT lessons were observed looking at opportunities for students to engage in practices with technology in the classroom. Both were Year 2 groups participating in revision sessions for forthcoming ICT subject examinations. ICT is taught and assessed as a specific skill set and curriculum subject, examined by a formal written paper at the end of the second year of college practice.
- An analysis was made of teaching materials written by tutors and a sample ICT examination paper.

- Field notes were taken throughout the week which help to understand the context.

## **Stage Two**

Year 2 students were revisited to follow up or clarify any points in the light of researcher review and initial analysis. A debrief session with students and staff was offered but due to timetable constraints, this offer was not taken up.

### **3.6 Data analysis and presentation**

Braun and Clarke's six phase approach to thematic analysis was initially used to interpret the large quantity of written transcripts (2006, p87). After familiarization with the data through immersion and repeated reading, step two was approached, generating initial codes, where specific examples of student's digital literacy learning were investigated. From this process, step three involved searching for themes which re-focused analysis at the broader level, starting to analyse codes (p89). After review, the themes were defined and named before reporting on the outcomes. Individual students, tutors and the focus group were treated as separate data, meaning there were ten transcripts in total. As the body of research was large, cameos for each student have been presented in Chapter 5 to give an authentic voice and context for each individual. Appendix F presents a meta-analysis of the student interviews and focus group, drawing together themes. Data was also considered within the LWG framework as a basis for analysis.

With rich, qualitative data sets such as this study generated, it raises the issue of what to include in the body of the dissertation or the appendices. This has therefore influenced the choices presented in both. Given word count limitations, key data is presented in the body of the research including participant quotes to illustrate points made.

### **3.7 Risks, including protecting against bias**

Scholarly research depends upon researchers considering risk and protecting against bias at all stages of the research process. Practical challenges were addressed through careful planning and an awareness within research analysis. Two areas were identified as most relevant in this project: access and choice of participants, and the interpretation of data.

There are risks involved in the selection of participants for any study. Gatekeepers may have selected students consciously or unconsciously to create a good impression, protect reputation, or if requirements had been unclear. Selecting certain groups and excluding others, e.g. your perceived 'strongest' students, can mean that data is skewed and biased. This research aimed to hear from individuals about their experiences and it was important to seek representation from as wide a range as possible. For this reason, the following steps were taken to try to mitigate risk.

Firstly, the tutor was asked to select up to six participants from as diverse a range of backgrounds as possible, to include students from different regions, tribes and language groups, religions and so on. The focus was on primary practitioners or those teaching within the 4-12 age range. All the students selected were in Year Two of their training as they had completed their college study which enabled analysis of the whole of this period of their training. Secondly, the tutor was asked to organise a focus group of those students who had experience of school teaching. These participants were all Year 3 students who had spent a year in different primary schools. Thirdly, all members of the ICT department agreed to be interviewed.

As there can be drawbacks using just one method, several qualitative methods were utilised to provide a wider lens through which one can investigate a social situation and

which may counteract any possible threats to validity that may arise.

The second main risk to be mitigated was the potential for bias in taking an interpretive approach to data analysis as this can be value laden. Interpretivist approaches attempt to understand teachers' lives from their perspective, acknowledging that different interpretations are possible and are thus subjective. Within this approach researchers cannot assume that what is observed or explained is interpreted in the same way by other people, therefore it is important to look at possible different interpretations and understanding. Interviews can be said to be false situations as even if the research is attempting to gather data in a naturalistic environment, just by being there it changes things. This is also true of classroom observations. Steps were taken to ensure that as far as possible, classroom tutors were asked to avoid changing their practice or prepare 'special' lessons on account of a research visit. In the event, limited opportunities were available to do as many lesson observations as hoped and those that were possible focussed revision. However, this did not significantly impact the design of the study.

Finally, taking an inductive approach meant that it started with a research question and used observation, description and analysis to reach an understanding so it is important to note that personal background and assumptions could have led to subjectivity or bias.

### **3.8 Ethical considerations**

There were ethical considerations at all stages of the project and plans put in place to ensure that it met Open University and BERA Ethical Guidelines for Educational Research, ensuring that no harm would come to any participant and that overseas fieldwork would be safe for the researcher.

An application was submitted to the Human Research Ethics Committee (HREC) and received approval in May 2017 (reference HREC/2017/2545/Taner/1). Consent forms and information sheets for participants can be found in Appendices D and E. The project also conforms to Data Protection guidelines and has been deemed appropriate by the OU Data Protection Officer. The formal requirements for entering the research setting after HREC approval was direct contact and permission to proceed from the college Principal as the main gatekeeper.

Hammersley explored the ways in which ethical considerations must be taken into account within any research project, highlighting informed consent, privacy, the avoidance of harm or exploitation of participants, and consequences for future academic research as guiding principles to observe. In addition, the six OU HREC ethical principles (2014) were considered and extended to include a duty to protect researcher and participants by undertaking fieldwork risk assessments and additional training to methodically plan the data collection process.

All participants were reminded of their right to withdraw at any stage of the process and afterwards through explanations about consent, following BERA and OU guidelines to ensure that participants were treated fairly, sensitively and with dignity; that secures their voluntary consent, privacy and understanding of the research process, safeguards their confidentiality; causes no harm and seeks to minimise the impact of research on normal workloads, especially in a challenging environment such as this. Year 3 students recalled from the field had their school absences approved by school based mentors and were reimbursed for their travel costs to limit financial impact.

## **Chapter 4 Collecting and analysing the data**

### **4.1 Introduction**

Data collection took place over a one week visit to a College of Education in Ghana during June 2017. Timetabled meetings and activities ensured that data collection proceeded according to the research plan.

### **4.2 Context: The research site**

The research site is a College of Teacher Education that has existing relationships with the Open University and academics working in the field of teacher education. As such, it was known to have an element of expertise with ICT and digital technologies in comparison to many other training colleges and as such, was an appropriate leading-edge institution to investigate digital literacy in teacher education. It has also been part of the TESSA programme for a number of years. The college is one of nearly 40 such institutions nationally and serves a large female student population. It is situated in the south of Ghana, in an area of relatively higher affluence than much of the rest of the country. The college is comparatively well resourced, including facilities for ICT such as a computer lab and extensive WiFi available throughout the campus, including many of the accommodation residences. Students may use ICT lab facilities from 7am to 9pm each evening and all students interviewed were highly positive about the internet accessibility available to them. This access is not necessarily typical of other teacher colleges (Edumadze, 2016).

The college sits within attractive and neatly kept grounds, which the students help to maintain. They come from all regions of Ghana and on-site accommodation is provided in dormitories for all Year 1 and 2 students. Third years live in the communities in which they are posted. On campus students are provided with meals three times a day and



a set of different uniform dresses are distributed at the start of their course for different occasions, e.g. everyday wear and more formal off-site wear, with Year 1 and Year 2 students differentiated by their uniform. All uniforms are included within the regular fees so students from all backgrounds are equally provided for. The college environment is well ordered and the day closely timetabled. Days begin early at 7.15am with formal learning in classrooms across campus until mid afternoon, followed by a break and timetabled prep time. They regularly gather together in a large auditorium for an address by the Principal. Students are expected to be in their dormitories by 9pm. Off campus time is restricted and therefore mobile phone contact with families is valued.

All students are enrolled on the DBE which gives them a teaching qualification for Basic School (primary) and Junior High School (JHS), equivalent to a UK or US middle school. Within this structure there are specialisms: General students are prepared to teach all subjects at primary level; maths and science specialists can teach up to Junior High School (JHS) and Early Childhood specialists teach all subjects in the early years. Each student follows a curriculum covering all primary school curriculum subjects including ICT, with additional modules on teaching methodologies. ICT is taught as two modules in year two which focus on basic ICT skills, including troubleshooting hardware and software issues, word processing and spreadsheets, which aim to support their practice as teachers. For example, tutors recommend that students use Excel as a way to record and track pupil scores on tests and Word to assist students writing up assignments, for example the Year 3 research module.

Year 3 student teachers are posted to different schools in pairs or groups and according to the focus group teach two subjects per term, rotating to new classrooms. Sometimes they were posted in pairs to the same classroom, meaning that large classrooms at times had three adults working in them, including their teacher mentor.

All had taught ICT, many with great difficulty due to inadequate infrastructure and resources.

### **4.3 Initial approaches and selection of participant sample**

Initial email contact with the college had been problematic but during the fieldwork, more effective communication was achieved using WhatsApp over email as there was a much lower delay in the response. The data collection process was organised with an ICT tutor who contacted a group of students on the researcher's behalf. There were advantages and disadvantages in having students being approached and asked to participate in this way. The main advantage was the level of diversity achieved in the sample: all students were from different regions, tribes and groups: there was representation from six Ghanaian regions amongst the eleven students interviewed, including one born in a different West African country. There was also representation from each of the college courses on offer, General, Maths and Science and Early Childhood, meaning that students could talk about their particular course detail. All of the students in the study were female and in the age range 18-26. Half could be considered 'local' as their families live in the same region as the college. The remainder came from all across the country. Year 3 students were selected as they had been posted to different primary school settings across the region and had taught for up to a year. The common denominator amongst all student participants was that they had access to a smartphone, which may well be a reflection on the ease of which it was to get in contact with them, as it had been reported that students in the field were constrained by limitations of connectivity, including phone signal.

The compromises made were that this group of students could have been more ICT literate than others and this may have given skewed impression of the level of competency in ICT within the student body. In addition, four of the year 2 students

interviewed were science and maths specialists, which may have implications for their perceived or actual skills with technology. In practice, at least one student was an absolute beginner in ICT before starting teacher training, having no previous exposure in school or the home. However, it was not felt that this issue affected how they reported on the curriculum being offered to them. Given the opportunity to carry out this research again, as well as diversity in student background, it might be useful to consider a balance of smartphone owners and others to gain insights from those without devices. However, the students' smartphone ownership allowed a window into these students' practices which was valuable to see what is possible. In practice, there were discrepancies in what students and tutors estimated about smartphone ownership on campus. It is still unclear what those statistics are.

#### **4.4 Interview Process**

All of the interviews were recorded using a digital recording device and a password protected smartphone app as backup. The entire interview corpus comprised of over ten hours recording. Transcription software was unable to accurately detect the different speech patterns and accents of the participants so all transcription was done manually. Whilst this was highly time consuming, it allowed for an intimate knowledge of the data. A password protected document identified the participants' names against the pseudonyms used for each person to retain their anonymity: Year 2 students are here named Abena, Agnes, Hope, Akasi, Yaa, and Sisi; tutors are John, Kwesi and Ekow.

## 4.5 Reporting the results

### Curriculum and Assessment for ICT in Ghana

Government policy is described in Chapter 2. Building on this, the ICT assessment regime in teacher education Ghana is theoretical and practical. The practical element is assessed by a school visit to see how students are using technology in their setting. The theoretical assessment is a written examination that could be said to be measuring the written competency of a student who must answer difficult and decontextualized questions about hardware and software. John, a college tutor, explains:

*'UCC are the examining body. Our course textbook is tailored to their structure and their exams. The government of Ghana sets the curriculum, but UCC gives us the outline for all colleges. We've all got the same thing. We teach them based on what the examiner wants. Yes, it is hard. You have to learn everything. And memorize everything. It's not easy.'*

The reasons why hardware and software knowledge is included in the curriculum is also explained, as there is an expectation that there will be no expertise in the school- and often no equipment either:

*'Here we need to know the hardware as well as the software, not like in the UK. When you go out, there might not be a computer out there. But you've been taught how to connect to computers, how to fix computers.'*

In effect, students are being prepared to be teachers of ICT and in all likelihood, the sole ICT technician in the school too.

### Lesson observation data

Parts of two ICT lessons with two different tutors were observed in the ICT lab. The first tutor was apologetic that this was a revision lesson which was expected as the request had been that the timetable should not be changed or disrupted at a crucial

time in the teaching cycle just before the examination period. Situated at the rear of the room for discretion, my presence may have affected the lesson for the tutor, but apart from greetings, the students themselves did not appear to be distracted by my presence and carried on regardless looking towards the front. Each of the sessions observed were revision session looking at multimedia technologies. Although no actual examples were shown in the session, examples and definitions were given and for a revision session not necessarily expected.

### **Student interview data**

A map of Ghana was available for each student to indicate where they were from to support their answers and to open up conversations about their choice of this college for training, which for some was at great distance from their homes and families. Students explained that they are posted to schools in their third year to schools with existing relationships with the college, providing the school community can accommodate a pair or more students in adequate housing. According to Year 3 students, buildings can accommodate up to twelve teachers per lodging, but none of the Year 2 students anticipated that number, assuming the number would be no more than half of that. The volume and complexity of data made analysis difficult and time consuming and students wanted to talk about far more than their experiences of digital literacies, often talking more broadly about their experiences within the open-ended nature of the interviews.

All the students interviewed own and use smartphones of various brands- five knew they were Android devices and one was unsure. Sisi estimated that most students own smartphones and others implied this was the case. She estimated about 40% of college students have tablets and 10% a laptop. According to one ICT tutor, smartphone ownership is not as common as she suggests and estimated more accurate figures as 45% smartphones, 10% laptop, 5% tablets.

Year 2 students report researching ideas and materials for teaching or for college assignments, communicating with peers and tutors as well as their families using WhatsApp messaging services; and searching online resources such as Wikipedia and YouTube or other resources recommended by their college tutors; as well as saving materials or ideas on their phones to use later. They all use WhatsApp extensively for college and social purposes, supporting their professional role and their academic work. Several mentioned using Facebook, Instagram and other social media but only one mentioned for teaching purposes. All students use Google extensively to search for ideas and resources which they select assessing each on the suitability for their situation. They appear to prioritise Google as a search tool over specific websites or resource banks designed specifically for teaching purposes, including those recommended by their tutors or saved on the college LAN. Year 3 students report taking the same approach in the college based years but in school, the very active peer communication systems using WhatsApp is much reduced due to a heavy school workload.

Year two students are introduced to ICT skills during their second campus year and use technologies in some other lessons, for example, some classroom have interactive whiteboards which they use for OCTP. Tutors often ask students to use their phones in class to support their learning although inconsistently, students report. When they are used in class, it is usually to search the internet for information. Students and tutors indicate that mobile phone use is allowed when the tutors request or allow it- student cameos gives examples of this practice.

In college, there are opportunities to practice and refine the taught ICT skills. In the school based year, this becomes more problematic and opportunities are restricted. These students report that the impetus to share and use WhatsApp as in previous

years reduces for a number of reasons and likewise, the 'sharing culture' described by Year 2 students appears to take a lower significance- survival in the field is their highest priority.

Amongst the student groups, three themes emerged from the six-stage analysis carried out in response to the research question that addressed the ways in which they are participating in learning experiences that develop their digital literacies, and these are:

1. Using digital technologies for communication to support academic development and course requirements, e.g. WhatsApp for academic purposes, including assignments; sharing resources and ideas and focussed discussion.
2. Planning for teaching: student teachers use their mobile phone to support teaching and learning with lesson preparation, both OCTP and school lessons, for example to source TLMs, get lesson ideas, or see practical examples of teaching, often in absence of other ways of doing so. Teaching and Learning Materials (TLMs) are the learning materials commonly used in Ghanaian classrooms and which might also be called 'learning aids' in other settings. They can be equipment or visuals aids, e.g. physical everyday objects, pictures, chalk or the environment; or digital materials e.g. OER. It is unclear if both these definitions are generally accepted and used outside the teacher college setting in schools as definitions of TLMs, in particular, digital materials.
3. In class teaching: how students use their device practically in class with children to support teaching and learning, or speak about the potential for doing so. Included here is how it is used in OCTP as well as directly with children.

A full breakdown of each response is included in Table B below.

<b>Summary of themes from student teachers</b>	Hope Yr 2	Yaa Yr 2	Akasi Yr 2	Abena Yr 2	Agnes Yr 2	Sisi Yr 2	Focus Group= 5 students
Owens and uses Smartphone	✓	✓	✓	✓	✓	✓	✓ All
Owens and uses Laptop				✓		✓	2 out of 5
Uses digital technologies for communication to support academic development	✓	✓	✓	✓	✓	✓	*
Planning: Uses mobile phone to support Teaching and Learning <i>for OCTP</i>	✓	✓	✓	✓	✓	✓	✓
Planning: Uses mobile phone to support Teaching and Learning <i>in schools</i> (Year 3s only)							✓
Uses mobile phone in class/ or talks about doing so <i>in OCTP</i>		✓	✓	✓	✓	✓	✓
In class teaching: Uses mobile phone in class/ talks about doing so <i>in school</i> Year 3s only							✓
* All Year 3 students were using WhatsApp as described in this category in previous years on campus but 'out' they do not, except to contact tutors about their projects or to arrange mentoring visits.							

*Table B: Summary of Themes for each student/ group*

These results demonstrate commonalities across this group of participants, supported by tutor testimony to that effect. Apart from one student who had not mentioned using



her phone directly with learners, all other students spoke about how they had learnt, used and applied digital literacies in the ways described. However, it is noted that on school placement, Year 3 students felt under pressure to prioritise independent living and teaching in sometimes difficult circumstances over virtual peer communication- at this point they relied far more on face to face support from their accommodation colleagues or those in school. Contact with tutors remained in place with regard to mentoring visits and ongoing assignments and projects but this too was disrupted by connectivity issues at points. A note is needed on reflexivity at this point: these analyses are likely to have been impacted by the researcher's history as teacher/ teacher educator, although care was taken to cross refer all data and avoid a hierarchy of interpretation.

## Tutor Data

Summary of themes from tutors	John	Kwesi	Ekow
Teacher Education Background	Worked in teacher education for 9 years. Completed National Service at this college. Co-authored college textbook for ICT.	16 years' experience teaching in total: primary (4 years) secondary (6 years) and teacher education.	Worked in teacher education for 22 years. Co-authored college textbook for ICT.
Teaches students about digital technologies and materials to support teaching and learning across range of subjects	✓	✓	✓
Suggests use of smartphones in schools; talks about benefits and barriers to use	✓	✓	✓
Uses digital technologies to communicate with students/colleagues e.g. WhatsApp	✓	✓	✓
Sees own role/identity as wider than ICT tutor, e.g. mentor, staff development, link tutor, wider role as teacher educator.	✓ <i>'we are looking at teaching in general that pertains to all... we are teaching students'.</i>	✓ <i>'Without ICT knowledge, it would be difficult for you. Using this it becomes so simple, rather than the traditional way. IT is sharing- a collaborative thing. Can introduce them to new, emerging things.'</i>	✓ <i>'We supervise students for a whole year, not just in ICT. It's academic and pastoral as well as teaching practice supervision...We link the practice in school with the college.'</i>

Table C showing a summary of Tutor interview responses

## **Chapter 5 Interpreting the data**

### **5.1 Introduction**

This chapter sets out to interpret the data using illustrative quotes from participants throughout. It also seeks to return to the literature to place the data analysis and interpretation within a theoretical context.

### **5.2 Reflection on the literature**

Some research has indicated an assumption that tutors are not preparing students for careers in resource-limited schools or are unaware of the challenges they will face, e.g. Lewin and Stuart. The situation is subtler in this context. Tutors are well aware of the difficulties and challenges in the schools where students are placed, as they mentor and visit them and talked openly and at length about the challenges with regards to using and teaching ICT and more widely. In this college, it does not appear to be the case that students are being prepared for idealised situations, but rather shown examples of what can be called innovative pedagogies and practices that in practice they find difficult to implement, given the challenges. Within the ICT curriculum tutors actively encourage the use of smart devices and recommended students save for their own laptop in the absence of a school one. Asare and Nti's note that enthusiastic students often 'regress' in school hides the same notion and places the new teacher at fault, rather than their being constrained by the power relations, culture and system they find themselves in.

Reflecting on the range of approaches taken to digital literacies, the approach taken within this college of education learning context, in particular the heavy emphasis on a skills-based curriculum with a rigid examination system, suggests it is more aligned

to Eldred et al.'s more functional approach to ICT competencies, as it is more numerically quantifiable or measurable (Moon and Villet, 2017a, p25). There was no evidence of their politically motivated, transformative approach, although Hope tells us that she believes teachers '*transform people- we change them*'. However, decisions taken by students in their out year and evidence from Year 2 students suggest that as with some of the rest of their learning, particularly in their networking, students position their own learning in more socioculturally situated ways:

*'We all don't have the same knowledge content, so for example, if I study alone I don't get the concepts. I ask, and then maybe with a discussion I'll get whatever they mean',* (Hope).

From the six-stage analysis undertaken, the three themes that emerged from the data related to the ways in which students develop, practice and use technology for their professional and academic roles. The data was looking for responses that answered the research question. Nevertheless, there was additional data in the transcripts that although not directly related gave a fuller picture of students' motivations and the choices they make in using digital technologies. This was considered vital to the process of understanding student's wider lives both within and outside their training. Cameos for each student below show how they use and apply their learning of digital technologies to better understand their contextual practices within a sociocultural approach, allowing for a closer connection with the participants' experiences and making the data more 'real' (Blaxter et al 2001, p74).

## **Abena**

Abena owns a smartphone and a laptop and uses both for

*'preparing lessons, so if I need to teach a science topic and I don't know how to break it into smaller chunks for the kids to understand, I would look through a website that has teaching procedure ideas to learn how to go about it. And also for TLMs and when I can't draw, I would look for pictures'.*

*'if it was a difficult concept to draw, we've been advised to use our mobile phones to get a video of it for the pupils to view. [But] in some places in Ghana there aren't computers in the classroom, so in this instance your smart phone becomes your I.C.T. resource. In the absence of an I.C.T. lab, that would be fine'.*

She prefers her mobile phone as it is easy to carry and she can easily use it for research. She connects with friends and colleagues by calling and using WhatsApp and values the campus WiFi:

*'Even if I don't have data, I can easily search for information to understand assignments'.*

She communicates with students and tutors in WhatsApp groups e.g.:

*'in a group, somebody can do research and say, this is a video, or here is an image. We share this in the class group. We share it and it's an agreement in the class group- an agreement for learning'.*

She talked about an example of group work in a module on educating children with special educational needs where the tutor organised students into groups to research various disabilities:

*'We had our phones out. One looked up communication difficulties and disorders, the second one how to manage [this] as a teacher if you have a child in your class. Then we all came together and presented to the class under the management strategies to all students'.*

Abena knows that life off campus may mean an absence of electricity or computers: *'If I'm at a place with no access to a computer lab then I'll use my smart phone so in that case, students won't get one on one use of a machine. If you are lucky there will be. If not, then you need to use your device'.*

She is already considering how she will cope with independent study off campus, which is a concern for her and plans to use WhatsApp to contact tutors for support.

## Agnes

Agnes uses a smartphone and two SIM cards. She visits an internet café during vacation periods. Off campus she 'bundles credit' by purchasing mobile phone provider credit which she uses for research for college assignments and for discussion topics set by the tutors in WhatsApp groups.

She uses her smartphone in class when requested to by tutors to research and share findings, e.g. in a Biology lesson, they researched a scientific process, watching a video that was suitable for classroom use '*so they can see it for themselves*'; by finding appropriate TLMs and researching teaching methods, e.g. videos:

*'Some children believe by seeing with their own eyes. They'll get a better understanding. When you go on the net you have to think about (TLMs) and judge if they are any good'*

Agnes uses her smartphone for assignments, often visiting Google. She uses WhatsApp groups for class assignments posted by tutors, shares ideas and participates in guided discussions

In the absence of WiFi, she would download resources like video '*for the children's*' sake so they can understand it'.

Agnes sees her smartphone as a way to remove some of the barriers to learning in the classroom on her 'out' year:

*'You can be taken to a place where there aren't enough resources, so you rely on your smartphone especially if you are teaching a topic that the children are not familiar with, and they don't get what you're trying to say or teach. That's why you need to make use of your smartphone'*.

## Hope

Hope connects with friends, colleague students, tutors and her family using her smartphone as well as frequent face to face interaction. Her regular contact is through WhatsApp messaging in groups and sometimes individual messages. She is proactive in seeking support from all her associates and chooses learning experiences in groups rather than individual learning:

*'If I study alone I don't get the concepts. I ask and then maybe with a discussion, I'll get whatever they mean. We do it based on studies, not just friendship'*

She seeks out 'academic' study group relationships over friendship groups:

*'I chose to be in a group where I don't have many friends. Even if you are not serious, you would be with serious people, so I chose to be with them.'*

Learning about technology has been a steep learning curve for Hope and she admits she did not have any experience before college with ICT or technology:

*'I didn't even know how to put on a computer.'*

Through ICT tutorials, independent practice and the support of staff at an internet café she approached for help, she feels far more confident now with both hardware and software.

## Akasi

Akasi owns a smartphone and appreciates the campus WiFi: 'We get full access here. It's everywhere!'

She doesn't normally take her device to class: *'But if a teacher tells us to, we are allowed to bring it. But if not allowed then maybe after school [you can] use it for your assignment research.'*

When she does use her phone in class, it is to:

*'search for a formula. Or if you are teaching them the digestive system of animals- there might not be pictures in the textbooks. And you need additional information so you'd use the Internet to get images'*

Akasi uses the TESSA website for science, numeracy and literacy options and WhatsApp individually and in groups. She explains how assignments are given out to classes:

*'We have our own WhatsApp group class Rep. She takes assignments from a tutor. And instead of writing it, she'll take a picture of it and put it on the class group.'*

She utilises the download facility to save items she has found on the internet:

*'So you get access to it any time. Even with that you can print if you want a hard copy. Because maybe you can't draw what you want to teach! So you can paste it in to teach.'*

She expects that she will need to buy data from her provider next year to get internet access and notes:

*"it's quite expensive. There's a thing on the networks where you can borrow credit. So you have no excuse you can't do your assignments or get access."*

She expects that there will be at least one computer at her school placement:

*'The school will have a computer. They should at least have one or two to teach the students because we are living in a global village and everything is about technology. So [the students] will need an idea about what it is- and it will really help them. You need at least one at a school.'*

Akasi also expects to use her phone although she realises that she may be 'posted to a place where getting access to... the joints who sell those cards for prepay' would be difficult.



## Yaa

Yaa owns a smartphone and uses it extensively for college and study and in her personal time too: *'I do everything on my phone. Life without it would be boring.'*

On campus Yaa uses her device to search for explanations and visual aids, e.g. for a paired teaching topic. She recalls using her mobile phone in a science lessons where there were not enough PH charts to go around to detect a colour change, so she downloaded one from the internet. If she taught a lesson on that theme next year, she says she would:

*'prepare a soft copy of the PH chart and print it out for each of them to check. Maybe using one phone passing round is wasting time... sometimes the textbooks and your knowledge won't be enough, so you need ICT to get more, and use it in the preparation'.*

She anticipates being able to use her mobile device in school on her placement year: *'When I go there I can use my phone for my research work, to teach them'*, assumes there will be a network in place and that practically all JHS schools will have an ICT lab as *'they cannot learn the theory without the practical'*.

When she needs academic support, she consults websites including social media to support her. In English Yaa uses an essay example and research website, reading the articles to help her answer assignments.

She uses WhatsApp to communicate with individuals and a large number of groups (class, year, halls, subject association) about student work and assignments:

*'I can attach the question I'm trying to solve there, so anyone can try their hands on this and can do it. Mostly they respond. If we get an assignment we don't understand we drop it in the class group. When any teacher wants to give us information, it goes in the class group cos we are all on it.'*

Yaa also uses other social media including Instagram, Twitter, and Facebook: *'Maybe you need ideas, you can post pictures or videos- on Facebook you can update your status for people to respond and help you'*, e.g. once when she was halfway through a maths calculation and became stuck, she took a photo of the calculation, shared it on her Facebook status and tagged people in to help.

She acknowledges the value of the free WiFi on campus: *'If they took away the WiFi, we would suffer 'cos not all of us can afford to bundle, so the WiFi is really, really important'*.

## Sisi

Sisi has a smartphone and says the majority of students own them *'it's like their life. Smart phones are really essential.'*

During teaching observation, she taught creative arts in a placement school using her smartphone:

*'I had to use my phone to go to the net and show them things. I was teaching them about costumes for dancing, storytelling. I went to the net and allowed them to interact with it. They didn't have internet connection. We looked for costumes for different occasions, and foreign ones too'.*

She also uses her phone for study: *'if I'm given an assignment and I don't understand and want more information, I'll go to the net and search for it'*. She relies most on Google search terms:

*'I would frame something from the text - plenty comes up but I have to go through it and select the best text or video. Normally I prefer reading so I read the text.'*

Sisi uses WhatsApp groups to support learning:

*'If I didn't understand something, I put it on the page. So you can share ideas... when you show your problems on a platform you get better understanding than to give them one on one. Learning during group discussions- that's the best way I can learn. To me it's more useful because people have different ideas.'*

Sisi selects TLMs from the internet that *'will match the children's level'*, are not theory based but practical, and those that will help her to evaluate their learning:

*'You need to evaluate at the end of every lesson so you know what they did and didn't learn. So maybe you think about another method which will help them to understand.'*

Sisi uses her phone in all classes if the teacher allows it but has not yet used it for maths. She is conscious that next year she may be posted to an area without the same level of connectivity:

*'In the past you wouldn't even get reception for phone calls, so if you need reception you might have to travel some miles before you get it, or be on top of a hill... maybe what I'm needing, I might be lacking'.*

Next year Sisi hopes to improve her ICT skills and hopes *'where I'll be put, they'll also be interested in using ICTs.'* If she is sent to a rural area, she will use her smartphone in the absence of computers. She is thinking about how she will manage teaching ICT to children next year: *'Explaining the concept of ICT to them is somehow difficult. You need practicals and then the TLMs, then the gadgets'.*

### 5.3 How students are developing and using technology practices

The campus WiFi networks enable instant access to information and communication tools that are fast and free. This has a major impact on the way all students and tutors on campus communicate with one another and the outside world and how they access teaching and learning resources to support their professional practice and for students, their academic learning also.

Smartphone usage seems to be particularly empowering as they can access tools and take autonomous decisions about their professional learning, as seen in Yaa's example where she posts unfinished calculations on Facebook.

All students source TLMs from the internet via their smart device. Year 3 students went as far as saying if they don't have any *'I have to skip it to the next day. I can't teach without a TLM'*. Several students spoke about drawing pictures and creating TLMs on cardboard to support their children's learning. Akasi recalls teachers in her own school days trying to explain concepts: *'They would draw... a bad drawing!'*

There were issues for some though. One Year 3 student stated:

*'I don't know how to draw. When it comes to TLMs, I'd prepare my lesson notes then go to a colleague to ask her to help draw it. I show my colleague and get her to draw it. When you show your phone, everyone wants to touch it. Once I took my laptop to class and it nearly fell down so I don't take it again. So I draw it on cardboard and paste on board for them to see. So drawing aspects are a challenge'.*

The implication here is that she is protective of her personal devices and does not want them to be damaged by excitable children. But there is a further implication in this

example, the idea that teachers might *need* to draw pictures rather than use technology to show something, e.g. a Google image. This raises the question of whether as well as the other barriers to use, a subtler layer of expectation exists where physical resources are expected or even valued over virtual ones. It is not clear whether this might be a school or systemic culture that might prioritise one over the other. If such rules or expectations exist that could discourage digital resourcing over physical ones, this could raise issues for the college programme as students may be receiving mixed messages. For now, students might 'develop a sense of the limitations of the methods taught in college' in terms of pedagogical conflicts and challenges in real classrooms (Akyeampong 2017, p201)

#### **5.4 How students are using technology to develop their professional role: In class teaching**

Despite the challenges in the field, some students are trying hard to overcome a lack of resourcing in classrooms. In this instance, one year 3 student recollected how she used her mobile phone to demonstrate a concept and a practical examples of how a teacher, probably overseas, was using it in the classroom:

*'I was once teaching Class 6. The textbook I was using to teach the respiratory system was not enough, not enough information, so I have to use my smartphone, google it, then it came and I saw- most of the things I didn't even see in the textbook! So I showed them the real thing in the phone. I passed it desk by desk and they were all watching it. I also used my TLM but they had a better understanding showing it on the phone. It was a photo and also- a teacher, a white teacher, was using it to teach the class'.*

This example illustrates the point that children had a better understanding of a concept

by seeing it, according to the student teacher. The content taught the teacher something that was missing in the textbook which she herself could tell was inadequate for her purposes, and the video provided a possibility she could assess for herself.

For all students in their out year, there was a significant lack of physical TLMs- not enough books, inadequate resources and no provision of the cardboard for drawing that appears to be a common feature of many classrooms. This was one reason why students relied on smartphones in their absence. This was especially true for ICT lessons where all needed to use mobile phones: *'It's essential'* (Year 3 students).

One student considered herself lucky to have access to an ICT suite in the community, but described how she could only use it one lesson in four, meaning that the majority of her teaching remained theoretical. Others talked about no resources at all, or being prevented from accessing resources in favour of teachers in other classes:

*'In my school, the upper primary go to the ICT lab. We the lower primary school teachers used to use our smartphones as our laptops. There is no laptop so only they'd have the mouse to show the children. They would do the oral aspects, leaving the practical aspect, so that's the kind of challenges we face. So we have to talk about it, write it on the board for them to copy it, and manage it...so that's what the problems we are facing over there'.*

Given that the ICT curriculum states that pupils must acquire basic ICT literacy and internet skills and be able to communicate effectively using ICT tools, an assumption would be that schools are equipped with basic equipment for this purpose and that this might precede learning about subsequent software applications and methods of communication through ICT (Government of Ghana, 2015). Policy and practice for these teachers indicate low levels of ownership and of understanding at school level (p18-19) In those cases, smartphones became teachers' only ICT resource.

This leads to a theme that was subtler than others to identify: a possible mismatch between what's taught and expected of student teachers regarding their use of technology on campus and in the field, which includes the identified problems of connectivity, financial hardship and problems of infrastructure, as well as more human aspects. Kwesi talked about how in schools, Circuit Supervisors and Headteachers: *'are older people, not all of them... so when bringing in any new tech they don't understand, struggle with them before they understand. Depends on person's level of IT. Some know but don't want to use it. Depends upon the knowledge of person. There is a mismatch... some of them (students) are really good, innovative, show new things and so I believe when they go out, they want to show innovation.'*

A further problem hampering classroom practice is one of class size and space as even for the Year 3 student with access to an ICT lab once a week, there were problems of classroom management:

*'What I do is, I have a laptop, so I bring that in for 49 pupils. All of them- using one laptop- you can imagine! So I call them in groups, explain things to them group by group, so that's how I manage in between going to the main ICT lab.'*

Other students echoed this difficulty and discussed even larger class sizes:

*'Classes can even get to 50... 56, 57. And the class is SO small. Walking around in between the students is so hard. You just have to stand at the front of them always and just teach. The desks are so close you can't even walk around'.*

Class sizes for all of these students is unusually high compared with reported Ghanaian national data, which has a primary pupil per trained teacher rate (PTTR) of 45 (MOE 2015 b). All Year 3 students said overcrowding hindered their efforts putting into reality the group based activities they had learnt on campus as space did not allow for activity groups and interactive methodologies as had been taught in college. They

expressed great frustration with this situation and mentioned teaching ICT as especially difficult in terms of planning and teaching given the contexts. This presents additional challenge because in college, students are given learning opportunities with adequate facilities to practice the new skills. In low resourced placement school contexts, the opportunities for practising and learning are extremely limited. Along with the lack of physical resources or TLMs, the responsibility for which fell on them, this placed additional burdens on year 3 students who had assumed a certain level of provision in school as in college: *'I thought I'd find all my TLMs over there. So I thought I'd just find it and teach. I find it difficult preparing my TLMs.'*

### **5.5 How students make use of digital technologies to support their academic development and course requirements**

Communication between students, tutors and senior management is near instant and effective through the extensive use of WhatsApp, mainly in groups but also between individuals for professional and academic use. *'Most teachers rather use WhatsApp- they don't check their emails much. But they check their WhatsApp let's say every half an hour.'* (Ekow)

Examples of WhatsApp groups for students included class, study, accommodation, clubs and societies and subject groups. Akasi explains how academic assignments are distributed via the network:

*'We have our own WhatsApp group class Rep. She takes assignments from a tutor and instead of writing it, she'll take a picture of it and put it on the class group.'*

Abena talks about sharing in groups and there being 'an agreement for learning' to do so. Class discussions are set up by the subject tutor, for example Ekow explained 'we post assignments and talking points- set up the concept, such as use of computers by

trainee teachers, the pros and cons, then they discuss on that channel.’ Abena explains how Reps or prefects would then ‘lead the class in a discussion. But if there’s anything we don’t understand, we invite one of the tutors to address the class’. Interaction can be multi-way and students have access to tutors on WhatsApp through a relay process whereby they send a message to the Rep who would do all the communication with the tutor, which appears to be a way to filter or reduce excessive messages to tutors who have high student/tutor ratios.

However, in year 3 on their field placements, these channels of communication reduce and become lower priority to students because of time, financial and network constraints. This group report that they used to: *‘normally share...so it was kind of effective. But right now.... (all laugh) ... everybody’s so busy, so we don’t have time to’.*

## **5.6 Findings**

Smartphones appear to be enabling tools that support student teachers access to resources and teaching ideas as well as academic support, but they are not without their own barriers of accessibility. Without access and connectivity in rural village schools, students are obliged to purchase data bundles, although they are unpaid and receive no allowances. Difficult choices are made between buying and using credit for personal, academic or professional use. For Hope, she is more worried about her basic needs than internet access:

*‘The problem here is, sometimes you been in school, you enjoy the life in hall and then when you go out, you will suffer before you get the food. So that one would be a challenge for me because it’s not that you get money and then buy food*



*outside. And so I think that when you are in school you benefit more than hunger out. You depend on yourself. Nobody else will provide for you. It would be very difficult for you to live. So it's also a challenge there'.*

Year 3 students agreed about difficulties in paying for data: *'It is your own responsibility. We buy bundles and data. If you don't have it, you're not going to do it.'*

Mobile phone coverage was an issue for some students and one tutor remarked how this had prevented one student from attending her own graduation as they had not been able to contact her at all. Sisi is also concerned about this:

*'if you need phone reception you might have to travel some miles before you get it. Or be on top of a hill. So if people don't have a smartphone.. they've got neither phone signal nor internet- they can't contact anybody. So smart phones are really essential'.*

Kwesi's data supports the students' concerns about use of digital technologies in the field where he makes visits to assess ICT use in practice. He sees these main issues: connectivity, coverage and frequent power fluctuations. *'Students must use their own smartphones...they must buy a bundle at their own expense. Mentors might bring a laptop- that's time consuming because students will be looking at one laptop in a class of 40-50 pupils.'*

### **5.7 Applying Moon and Villet's Phasing in Digital Reforms to Teacher Education in this college setting**

Moon and Villet's timeline of possible actions is now summarised with a corresponding section that attempts to define this college's readiness to adopt and progress, linked to student comments.

	Moon and Villet's three phases of digital reforms to teacher education	College's readiness to adopt and progress through phases
Phase 1: 2016-20	Current teacher education systems: some digital development	All Year 1 and Year 2 students now have access to online resources and digital communications on campus. Remote access is variable. Good quality OERs are being shared and form part of OCTP and practicum activities Online forums, in this case WhatsApp, is used extensively for learning at the student and the tutor level including tutor to mentor/supervising teacher communication
Phase 2: 2018-2022	Existing technologies fully exploited	College based students' access via WiFi and LAN, e.g. TESSA materials stored on LAN. Off-site access would make them further accessible to students on placement, alumni, new modes of students, e.g. sandwich students.
Phase 3: 2020 Onwards	Future digital affordances for teacher education	The issue that looks most readily available to this group of learners is the existing one where students are led by class reps in discussion via online tools. Being given prior access to a range of online resources might well support the quality of those discussions and could be further moderated by tutors adding their input. Better infrastructure, wider connectivity and smart device ownership could make flipped classrooms a possibility.

*Table D showing College's readiness to adopt and progress through Moon and Villet's Phasing in Digital Reforms in Teacher Education (p32)*

Hennessey et al, (2010, p41) found that teachers believe that use of computers benefits their learners, and this is a message coming from tutors in lesson observations as they spoke of multimedia tools motivating young learners, whilst students also spoke about children's' interest and motivation when they used devices in class. In this aspect, the

'implication is that teachers will be inclined to use technology if they perceive it to be useful' bears out for these students. What is not clear is if there would be a level of resistance from any other section of the education community.

## **Chapter 6 Conclusion**

### **6.1 Introduction**

The literature review concluded that evidence of how teachers develop digital competencies or literacies to enable them to access online professional development materials is scant. This study has responded to the theme in a limited way with a small group of teachers in Ghana. What is apparent is that opportunities to develop such skills are taking place and the implication is that it could open up the opportunities for the online professional development some researchers have suggested could support new modes of distance learning.

### **6.2 Further areas of investigation**

Future research might investigate the following areas. Firstly, how student teachers are being prepared to teach in challenging contexts across a longitudinal study that examines the training provision and possibilities for digital technologies within that across a study of college students in years 2 and 3, and in their newly qualified year and beyond. Secondly, a comparative approach could be taken between students with and without mobile technologies and how these students are coping in classrooms, possibly related to inequalities within student cohorts. Finally, the discovery that there may be hidden, underlying social barriers to the use of technology in the field even when these other physical barriers are overcome, mean that an investigation into social

practices of using technology would be a profitable way to extend this research with some qualitative work to investigate if this was a more systemic and cultural issue than one of technology and skill. On reflection, an examination of Engeström et al.'s activity theory from the outset might have provided some illuminating evidence of the wider social structures that both hinder and encourage trainee teachers use of digital technologies, and this is something that could be taken forward for future research (1999). In this study, the surrounding theories of community, division of labour and so on may have gone some way to explaining the issue of 'rules', hidden or otherwise, that have been alluded to in this study. Future research might embrace an activity theory approach to investigate what the rules are and how they come about. On reflection, it would have been valuable if the researcher had been privy to 'marked' lesson plans to see if this could support a hypothesis that such rules exist.

### **6.3 Strengths, weaknesses and limitations of the research study**

This study does not attempt to make generalisations about the situation for all student teachers in Ghana. Even in this setting, the experiences of a different group may have given different results. What can be assumed across the group of 11 students in total is that they utilise their mobile devices for the benefit of their academic and professional learning in many situations. This study found out what sort of digital literacy practices students engage with in both learning context of college and school setting, and includes looking at the social communities in which they engage in these practices. It took into account the 'official' college line from three separate tutors, whose points of view were aligned in how the college approaches the specific integration of ICT skills within the curriculum, including off-campus.

The limitations of this study are that the two groups of student teachers selected could have been randomly selected, but this may have led to the prevalence of a dominant group. In practice, Year 2 students were selected for diversity and it was important because discussions about the languages used or not in classrooms was something students spoke of with frustration, as many found difficulty making themselves understood in classrooms where they were not competent in the local language, relying instead on the teacher mentor to translate. Likewise, Year 3 students in the field were selected as they were from five different primary schools so could talk about their different training settings and experiences. The two-stage interview process allowed for some reflection time and provided a valuable opportunity to revisit the Year 2 individuals having spoken to the Year 3s. This proved important because it suggested a mismatch between what students expect and are prepared for and what actually happens, raising the issue of transition.

Data collection methods can involve an interpretative process as the researcher is required to make judgements about what data is recorded, used and analysed. Interview transcripts for this study were used in their entirety, transcribed by hand and all discussion was considered in analysis. However, the interviews were guided by the researcher using open ended questioning and in this way it can be said to be somewhat subjective. It is also vital that all data are coded and analysed with a reflexive awareness and that data are '(re)constructed in the process of transcription' (Poland, 2002, p630) avoiding unhelpful 'tidying up' to construct a more written-looking text. It was also advisable to consider all the data equally, as some of what appeared at first to be irrelevant later turned out to take on new meaning, e.g. students talking about drawing on cardboard took on a new significance when considering the unwritten rules for accepted classroom resourcing.

Finally, it must be stated that all analysis relies on the existing ideas of the researcher, in terms of both the empirical study as well as the literature with which they are familiar, the limitations of which can skew interpretation (Hammersley 2007, p159) Using several methods to collect different kinds of data can provide a wider lens through which to investigate a situation and triangulation can counteract any possible threats to validity that may arise.

#### **6.4 Conclusion**

Innovation is happening all over the African continent according to Leach (2008). She vigorously challenges 'technological', 'donor' and 'transmissional' models, contesting the belief that ICT access and infrastructure in rural Africa is so undeveloped that basic needs should be a higher priority for rural communities and not ICT; or that technologies are too complex for rural teachers to understand (p787). These paternalistic ideas are dismissed, alongside the assumption that ICTs add nothing distinctive to effective teaching and learning. She argues that we simply cannot wait *'until the last school in the last province has electricity before they begin to evaluate and implement good practice in the use of technology'* and asks why such opportunities are being denied particular groups that she asserts is an 'unfreedom'. This research responds to Leach's work by asking how and in what ways educators can be supported *'to explore for themselves the benefits and drawbacks of ICT and to make their own informed choices about the relevance and appropriateness of such new technologies in their specific contexts and experiences'* (Leach, p.791).

[end]

*I note with gratitude the hard work in organising this research visit by the organising tutor and his team and thank the college for their warm welcome. It has been a pleasure to meet the student teachers in this study and a privilege to share their experiences with the wider research community. I thank them for their time, enthusiasm and honesty, and I wish them great success in their teaching careers.*

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# Appendices

## Appendix A: Interview Guideline Questions, Students

### Guiding Interview Questions for student teacher (1-2-1s)

- Introductions, formalities and thanks
- Informed consent- time to read all information and discuss consent forms including opportunities to withdraw consent
- Explain two-stage process of interviews

Please tell me a bit about your background, where you are from (national map as prompt), where you were educated.

What brought you into teaching? Why did you want to be a teacher? What kind of teacher do you want to be? Have you worked in schools before?

What kind of devices do you have access to?

How do you use these technologies?

What kinds of materials or resources do you use to help you in your training/ to become a teacher? Why these ones?

How do you find them, access them? What do you do with them?

Who do you learn with and from? Who you seek advice from, who helps you?

Where have you had most opportunities to develop these skills?

What are the expectations for use of technology in college and outside these spaces?

Thinking about how you've been prepared for teaching in schools and the challenges you might face, what did you learn? What was most useful for you? Is there anything else that you need or want to learn?

What's challenging or complicated about using technology? Why?

Is there anything else you'd like to mention?

### Part Two

Questions will be iterative based on stage one.

## **Appendix B: Interview Guideline Questions, Tutors**

Questions will be iterative based on lesson observation and student responses during the week.

- Introductions, formalities and thanks
- Informed consent- time to read all information and discuss consent forms including opportunities to withdraw consent

Please tell me a bit about your background- what brought you into teacher education?

What technologies do you use and how?

What are the materials or resources you direct student teachers to, to help them become a professional teacher? Why these?

What are the expectations for using technology in college and in school placements?

Can you tell me about the curriculum and assessment for technology here?

Can you tell me a bit about the background to your course text on ICT?

How do you develop as a professional? Who do you seek advice from, who helps you?

Thinking about how you prepare student teacher for teaching in primary schools, what are the most important knowledge, skills, understandings they need to help them be effective teachers?

What's challenging or complicated about supporting students to develop their use of technology? Why?

Is there anything else you'd like to mention?

## **Appendix C: Interview Guideline Questions, Focus Group and Activity**

### **Part One- Focus Group Q&A discussion**

- Introductions, formalities and thanks
- Informed consent- time to read all information and discuss consent forms including opportunities to withdraw consent

Please tell me a bit about your backgrounds, where you are all from (national map as prompt), where you were educated.

You have all worked in primary schools this year. Can you tell me a bit about that?

What are the expectations for using technology in college and in school? How have you used it in both spaces?

Who do you learn with and from? Who do you seek advice from, who helps you?

Where have you had most opportunities to develop these skills? (ICT, digital literacies- use the language they use)

Thinking about how you've been prepared for teaching in schools and the challenges you might face, what did you learn? What was most useful for you? Is there anything else that you need or want to learn?

What's easy or challenging/ complicated about using technology? Why?

### **Focus Group activity**

Practical activity that generated discussion about students' ideas on what constitutes 'good' resources to enable them to talk freely about any use of resourcing, particularly technologies, during their school placement. The activity is a set of cards labelled with statements about what constitutes 'good' resources in their opinion, e.g. 'It is easily accessible'. All cards are to be discussed together and then some cards are to be discarded if considered least useful. In addition, blank cards and a pen will be provided to enable them to create their own categories to add into the mix of those offered.

The final resulting cards will then be ranked according to the importance the students accorded them, in the way they see fit (linear, pyramid, diamond 9 etc.).

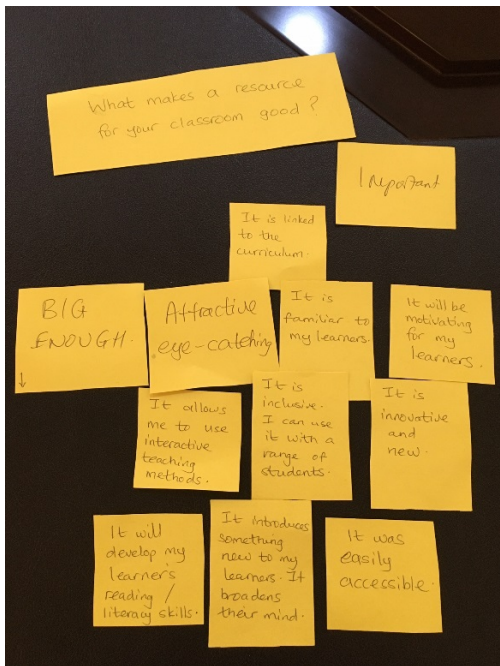


Image 1

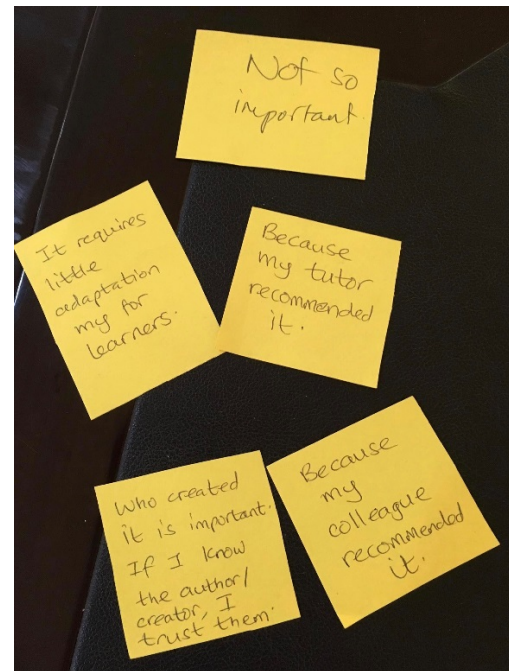


Image 2

Image 1: *Ranked categories of what makes a learning resource 'good'*

Image 2: *Discarded cards- least important*

## **Appendix D: HREC documentation, Consent Form for research participants**

### **Consent Form for Participation in Research and Dissemination**

**Research theme: How are student teachers in teacher training college in Ghana developing digital literacies in order to develop their professional practice?**

Lisa Taner, Postgraduate Research Student at The Open University, is researching how student teachers in Ghana develop digital literacies.

This research seeks to gather knowledge on how student teachers in Ghana develop digital literacies whilst training at teacher training college. As part of this research, data will be collected in a number of different ways including interviews and observations using audio recordings and note taking.

Individual and focus group interviews will take place in quiet rooms between the researcher and the research participant(s) and will be audio recorded using a digital recorder and a mobile phone app as a back-up. All interviews will be seeking student, tutor or principal points of views about the development of digital literacies in the curriculum at teacher college. The lesson observation will help the researcher understand what the formal curriculum looks like at the college. The lesson will not be recorded but field notes will be taken and these will record which aspects of the formal curriculum are being taught (content), what opportunities student teachers have to develop their digital literacies (pedagogies), and how these link with student teacher's development of their professional practices.

#### **What will I be talking about? What will I be observing?**

I will be asking student teachers about the kinds of digital literacies the college supports student teachers to develop within the formal curriculum and your opinions about this. I will be asking tutors and the Principal how they plan to develop student digital literacies and their opinions on this from their perspective. The lesson observation will help the researcher to see what kind of learning takes place within the formal curriculum.

All audio recordings will be transcribed (written down) by the researcher after data collection and anonymous user names will be used to identify individuals to the researcher only. After transcription, audio recordings will be deleted from storage on all computer systems by September 2017. Transcripts will be anonymised so that individuals will not be identified by any person other than the researcher at any point.

Anonymised extracts and quotes from the data may appear in research outputs including publications such as a Master of Research dissertation and in other dissemination activities such as written reports, published papers or presentations. Your anonymity is assured at all times, now and in the future.

**Participation in this research is entirely voluntary. Participants can withdraw from the project at any time** without explanation or prejudice and can request the destruction of any data gathered until it is anonymized at the point of transcription, which will be July 10th 2017. After this point data will have been processed and it will not be possible to withdraw any unprocessed data.

**Your choice to participate will have no impact or bearing on your student grades, nor on tutor appraisal of performance as a college professional.**

By signing this statement, you confirm that you understand the above and are willing to participate in the research.

	Tick ✓
I consent to be interviewed by the researcher <u>individually/ in a focus group</u> (delete as appropriate) (all)	
I consent to audio recordings of the interviews (all)	
I consent to notes being taken in the interviews (all)	
I consent to my lesson being observed (tutor)	
I consent to notes being taken in the lesson observation (tutor/student) (delete as appropriate)	

Statement of Consent	Signature
<p>I am over 18 years of age and give my permission and consent for Lisa Taner at The Open University to use my confidential interviews anonymously for the purpose of this research and understand that I will not be identifiable in any outputs.</p> <p>I have been informed that I am free to withdraw from the project without explanation or prejudice and I can request the destruction of any data that have been gathered from me until it is anonymized at the point of transcription, which will be July 10th 2017.</p>	

Exceptions/additional conditions: (leave blank if no exceptions/additional conditions)

(For example: there may be one or more answers you share that you would prefer NOT to have included in the formal data collection. In that circumstance, this answer will be cut out of the audio recording and not transcribed.)

Name:	
Date:	
Institution/ organisation:	
Title/Position:	
Email address:	



## **Appendix E: HREC documentation, Information Sheet for research participants**

### **Further information (Q&A) about Lisa Taner's research on student teacher's development of digital literacies, June 2017**

#### **What is the aim of this research?**

The purpose of this study is to understand the experiences of student teachers at a teacher college in Ghana. The study will focus particularly on how student teachers develop digital literacies

#### **Who is conducting the research and who is it for?**

Lisa Taner, a Postgraduate researcher at The Open University is carrying out this research as a pilot study for her PhD and for the formal award of a Master of Research (MRes). Lisa Taner has received training in research competencies and methods as part of her MRes.

#### **If I take part in this research, what will be involved?**

I will be conducting interviews during June 2017 with a small group of student teachers, with at least one college tutor/lecturer and with the college Principal. These interviews will take **up to one hour each** and will be conducted at [college of education] premises on a day and time in the period 19-22 June 2017 that suits you and the college timetable. In addition, there will be an ICT lesson observation and if possible, a small focus group of up to 6 student teachers will be interviewed. All of the interviews and focus group will be audio recorded and later transcribed (written into note form) to help the researcher recall everything that was said in the interviews. To ensure your safety, photographic identification will be carried by the researcher and an ID badge from The Open University.

#### **Informed Consent and your right to withdraw**

Your participation in this research is entirely voluntary and will have no impact or bearing on student grades or performance nor on tutor's appraisal or performance as a college professional.

Participants can withdraw from the project at any time without explanation or prejudice and can request the destruction of any data that have been gathered until it is anonymized at the point of transcription, which will be July 10th 2017. After this point, data will have been processed and it will not be possible to withdraw any unprocessed data.

Consent will be needed from all participants: student teachers, focus group student teachers, college lecturers/tutors and the college principal. In addition, student teachers in the ICT lesson will need to give consent even if they are not part of the interview process.

#### **What will the interviews and lesson observation be like?**

All interviews with student teachers and college staff will be informal and semi structured. This means that it would be more like a professional and friendly conversation about your experiences of developing digital literacies as a student from your perspective; or in preparing student teachers with digital literacy skills within the curriculum as a tutor or the Principal. Interviews with the tutors and Principal will have no impact or bearing on individual student's grades or performance.

The lesson observation will help the researcher understand what the formal curriculum looks like in your college. The lesson will not be recorded but field notes will be taken and these will record which aspects of the formal curriculum are being taught (content), what opportunities student teachers have to develop their digital literacies (pedagogies), and how these link with student teacher's development of their professional practices.

**What will I be talking about? What will I be observing?**

I will be asking student teachers about the kinds of digital literacies the college supports student teachers to develop within the formal curriculum and your opinions about this. I will be asking tutors and the Principal how they plan to develop student digital literacies and their opinions on this from their perspective. The lesson observation will help the researcher to see what kind of learning takes place within the formal curriculum.

**Is it confidential?**

Your participation will be treated in **strict confidence** in accordance with the Data Protection Act. No personal information will be passed to anyone. I will write a report of the findings from this study, but no individual will be identifiable in published results of the research.

The content of the interviews will be confidential and only made available publically through anonymised research outputs that do not name individuals.

Individual interviews will take place in quiet rooms between the researcher and the research participant(s) and will be audio recorded using a digital recorder and a mobile phone app as a back-up. All audio recordings will be transcribed (written down) by the researcher after data collection and anonymous user names will be used to identify individuals to the researcher only. After transcription, audio recordings will be deleted from storage on all computer systems by September 2017. Transcripts will be anonymised so that individuals will not be identified by any person other than the researcher at any point.

**What will happen to the data collected and the results of the research?**

The researcher is following Open University and BERA ethical guidelines for the storage, collection and sharing of data. At no point will the individual's names or details be made public and confidentiality is assured at all stages of the research process.

Confidential audio data will be stored on a password protected laptop then transferred to a secure Open University server for the duration of the project. Data will be deleted from audio devices and laptops by December 2017 at the latest. Written transcripts and field notes will be stored on a password protected laptop until December 2017 and then deleted and archived on the OU server securely and anonymously for up to ten years. All materials will at all times remain anonymous and coded so that only the researcher is aware of coding relating to individual respondents. Coding records will also be deleted/destroyed by December 2017.

Anonymised extracts and quotes from the data may appear in research outputs including publications such as a Master of Research (MRes) Dissertation and in other dissemination activities such as written reports, published papers and presentations. Anonymised data from the MRes Dissertation may be reused for the researcher's PhD.

**What happens now?**

In May 2017 [College of Education] will be approached about the research taking place. If permissions are agreed, the researcher will make personal contact and request a visit to carry out the interviews at a time that suits you over the period 19-22 June 2017. Information about methods of recruitment will be discussed for example, the necessity for the Principal to bring the research to the attention of staff and students in the college to gain volunteers. If there are more volunteers than are required for the study, a short meeting will be arranged for tutors so that they might have the opportunity to suggest the best possible lesson to observe. In the case of students, a broad and diverse selection of students would be required. I cannot guarantee that everyone who volunteers to take part will be able to at this point but would value interested parties contact details for future research opportunities.

**What if I have other questions?**

If you have any other questions about the study I would be very happy to answer them. Please contact [lisa.taner@open.ac.uk](mailto:lisa.taner@open.ac.uk) or text/ message/call **+44 XXXXXXXXX**

You can also contact my senior supervisor, Professor Patrick McAndrew, Director of the Institute of Educational Technology on this email address [iet-director@open.ac.uk](mailto:iet-director@open.ac.uk)

This research has been approved by the Open University HREC review panel,  
reference HREC/2017/2545/Taner/1

## Appendix F: Meta-analysis of student interviews

Student	How using technology to support their professional role	How using technology to support their academic study
Akasi	<p>Internet images, formulas</p> <p>TESSA website gives you TLMs</p> <p>Downloading</p> <p>maybe you can't draw what you want to teach!</p> <p>Implies expectation that teachers must be able to draw: e.g. storytelling in English, Social Studies.</p> <p>Describes how students receive cardboard on campus for their TLMs 'but I don't know whether when we go out it will be given to us. I'm not sure. '</p>	<p>Owns smartphone</p> <p>Doesn't normally take her device to class: 'but if a teacher tells us to we are allowed to bring it.'</p> <p>Uses phone in class to 'search for a formula. you'd use the Internet so you get images'</p> <p>Use it for assignment research, search for formula, images</p> <p>Uses TESSA website,</p> <p>Utilises WhatsApp individually and in groups. She explains how assignments are given out to classes: 'We have our own WhatsApp group class Rep. She takes assignments from a tutor. And instead of writing it, she'll take a picture of it and put it on the class group.'</p>
Hope	<p>Googled. They showed me where to go using that equipment (Cuisenaire rods for maths) Then I was being taught by- It's like they have somebody who, when you open it, the person will tell you how to do it. {video}</p>	<p>Owns Smartphone- don't usually bring phone to class. Sometimes English language.</p> <p>Sometimes they permit us to use the phone for research 'Bring out your phones'</p> <p>You can send a message to a friend and the friend will give you an answer.</p> <p>information gathering</p> <p>WhatsApp messaging in groups and sometimes individual messages.</p> <p>Chooses learning experiences in groups rather than individual learning</p> <p>independent learning</p> <p>collecting information, wanted to check something or find something out.</p>

		<p>Use phones/ WiFi for study groups, research / assignments.</p> <p>Learnt all about ICT here on campus in tutorials class learning 'I didn't even know how to put on a computer'</p> <p>Internet café for typing to support academic work</p>
Abena	<p>'if it was a difficult concept to draw, we've been advised to use our mobile phones to get a video of it for the pupils to view. [But] in some places in Ghana there aren't computers in the classroom, so in this instance your smart phone becomes your I.C.T. resource. In the absence of an I.C.T. lab, that would be fine'.</p> <p>Abena owns a smartphone and a laptop and uses both for</p> <p>'preparing lessons, so if I need to teach a science topic and I don't know how to break it into smaller chunks for the kids to understand, I would look through a website that has teaching procedure ideas to teach this topic, to learn how to go about it. And also for teaching and learning materials and when I can't draw, I would look for pictures'.</p> <p>A smartphone. a laptop</p> <p>Expects to use device</p>	<p>Owns laptop /phone- prefers phone is easy to carry.</p> <p>Sometimes the tutors tell us to bring the small phone to class. But other times we don't- it can be a distraction. When you're in class, if that tutor hasn't told you to bring your phone, you need to give maximum attention to the teacher. So we're all doing it together as a class'</p> <p>Gives example of researching SEN in groups in class</p> <p>Uses WhatsApp, search for information. Assignments.</p> <p>WhatsApp: 1-2-1 and groups- We share this in the class group. We share it. it's an agreement in the class group -an agreement for learning.</p> <p>There's also the class rep who represents the class. So the Course rep would lead the class in a discussion but if there's anything we don't understand we invite one of the tutors to address the class</p> <p>Group activity-SEN- The teacher informed us early</p> <p>Class Rep, who leads the class in an online discussion, set by tutors</p> <p>relay messages in groups</p>
Agnes	<p>Uses it in class when necessary- We will get prior notice so we know today bring your phone to class. Those with laptops can bring those e.g. OCTP</p>	<p>Smartphone and two SIM cards sometimes a café during vacation bundle credit.</p> <p>research for college assignments and for discussion topics set by the tutors</p>

	<p>find the method and procedures we can use for teaching.</p> <p>research then write it on planning</p> <p>have them see a video.</p> <p>Biology video example</p> <p>you rely on your smartphone especially if you are teaching a topic that the children are not familiar with. And they don't get what you're trying to say or teach. That's why you need to make use of your smartphone</p> <p>She uses her smartphone in class when requested to bring it in by tutors and for on campus teaching practice (OCTP) to find appropriate teaching methods and teaching and learning materials (TLMs), e.g. a video to support children's learning:</p>	<p>and managed by subject prefects, usually in WhatsApp groups.</p>
Yaa	<p>Use of mobile device:</p> <p>On campus- during classes to search for something, as req'd by tutors</p> <p>Explanation- need a visual aid, Example- search and share visuals. Images- sometimes videos, download PH chart.</p> <p>Maybe using one phone passing round is wasting time.</p> <p>You need ICT to get more and use it in the preparation. During the lesson and after that's when you give the assignment and ask them to use the internet.</p> <p>Syllabus for subject, textbook, when not enough use internet to research for more. I got more resources from the internet.</p>	<p>Search internet for explanations</p> <p>Not used in all the lessons Not utilised: Maybe English language</p> <p>read articles for the subject</p> <p>College WhatsApp groups? Year group, hall group, associations</p> <p>Social media- FB: you can post pictures, update status for people to respond and help you. share it with them and they'll help you.</p> <p>For more information assignments</p> <p>Research module on out year</p>

	<p>TESSA Africa.net (although she doesn't use it)</p> <p>Download to your phone.</p>	
Sisi	<p>Costume example phone</p> <p>Go to a search engine –Google.</p> <p>T.L.Ms. match the children's level. It also helps me find the TLMs to help their understanding. On how to evaluate them, less in theory.</p> <p>When I need much detail about what I'm going to teach, or I've got a new idea and I want to see how it works, I'll use the internet</p>	<p>Owns smartphone</p> <p>You're allowed in all the classes if the teacher allows it we use it in every class but I didn't see it in a math class before. it depends on what you were doing. some teachers do request we bring it to class</p> <p>assignment</p> <p>I'd look for a video to help me.</p> <p>WhatsApp groups you can share ideas</p> <p>Uses social media a lot</p>
Year 2 Themes- grouped	<p>Two talk about drawing /making TLM visuals explicitly</p> <p>To source TLMs using search engines, e.g. images and videos, formulas, teaching procedures, one mentions evaluation (assessment)</p> <p>Sharing materials</p>	<p>Features across all:</p> <p>All own smartphones of various kinds – Android majority</p> <p>According to tutors this is not common: (10% laptop, 5% tablet, 45% smartphones)</p> <p>Some don't take it in usually</p> <p>All bring it when told by tutors with advanced warning</p> <p>Sisi: You're allowed in all the classes if the teacher allows it we use it in every class but I didn't see it in a math class before. it depends on what you were doing. some teachers do request we bring it to class</p> <p>Assignments</p> <p>WhatsApp groups: Two-way (multi way?) communication in various groups, often organised by the students themselves. Tutors use to send out assignment via class rep (And instead</p>

		<p>of writing it, she'll take a picture of it and put it on the class group.')</p> <p>Send general messages and notices.</p> <p>Class rep leads discussions set by tutors, they research and contribute, tutors invited to address class if difficulties- f2f, online.</p> <p>Students can contact Tutors via class rep.</p> <p>Few say images, most use video</p> <p>Smart devices an alternative to expensive technologies and students are highly motivated to use them, even when they have access to alternatives</p>
Year 3 Focus Group	<p>Lack of TLMs- not enough books/inadequate- smartphone to support. Vital.</p> <p>In absence of computers, all are using mobile phones 'It's essential'.</p> <p>Forced to deliver theoretical ICT lessons in absence of equipment. Use phones.</p> <p>Unable to use the pedagogies and practices taught- huge classes, overcrowding etc. 'you can't even walk between them'</p> <p>Own responsibility to buy data 'We buy bundles and data. If you don't have it you're not going to do it.'</p> <p>'Find lesson ideas from the net. So you can find lots of things and improvise. Things to use for creative arts. Google Wikipedia- cos they simplify the explanations they give'.</p> <p>The barriers of accessing TLMs by having access to tech vs what they are 'supposed' to be using TLM wise</p> <p>If I don't find them I have to skip it to the next day. I can't teach without a TLM'. They all agree, would skip it.</p>	<p>They can connect with other teachers/colleagues but lots of barriers, financial and time being main ones they state.</p> <p>- Social networks. WhatsApp and sometimes FB. Or call. In practice there is far less of this going on in this year than previously- groups and 1-2-1s. Class groups, discuss assignments, 'normally share, or if absent some can send an assignment on the page to read, so it was kind of effective. But right now....'</p> <p>One belongs to external groups from the college – an IT group. Share research. Practical things. How to download, IT boot disk etc.</p> <p>Call mentors back at college/ messages</p> <p>Everybody's so busy so we don't have time to share this year.</p>



	<p>Some are very easy to get. Others are prepared by ourselves, go and buy cardboard.</p> <p>Class size- not prepared for Low tech/ no tech- not enough resourcing, compared to in college (e.g. whiteboards and marker pens)</p> <p>Expenses/ obligation to pay for own TLMs, and live independently. No bursaries.</p> <p>Drawing- 'I don't know how to draw. When it comes to TLMs, I'd prepare my lesson notes then go to a colleague to ask her to help draw it. I thought I'd find all my TLMs over there. So I thought I'd just find to and teach. I find it difficult preparing my TLMs.'</p> <p>Do it on phone instead- Google images, I show my colleague and get her to draw it. When you show your phone, everyone wants to touch it. Once I took my laptop to class and it nearly fell down so I don't take it again. So I draw it on cardboard and paste on board for them to see. So drawing aspects are a challenge.</p> <p>Lesson note (planning docs) - they have to take it really, really seriously because our headmaster is really strict with the lesson plans- he has to correct this and this and this- but that's also helped us a lot because when I go out, that won't be as stressful to make my lesson plan.</p> <p>One admits to still teaching theoretically 'not drawing' –and wishes taken methods seriously</p> <p>Year 3s do not share ideas and resources any more. Everybody's so busy so we don't have time to share this year 'Just keep it and use it. Not share it- because way of programme everyone is busy, keep practising for the next subject the next item but if you were professional teachers you would share something with your colleague. '</p>	
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All students

How students are using technology to support their professional role and academic study

1. All own and use smartphones
2. All source TLMs from internet via their smart device, teaching procedures/lesson ideas
3. There is a mismatch between what's taught/expected of use of tech for use in professional role in Yrs1/2 and in Y3 in the field, for many reasons including:
  - financial difficulties
  - inadequate network access/coverage
  - class size/restricted space
  - A school culture/ system that might discourage digital resourcing over physical ones, e.g. the repetition that cardboard is used for drawing and pasting to the class blackboard, despite students saying they had a better understanding showing it on the phone. In addition, several other significant barriers prevent student teachers carrying out their role effectively, e.g. language barriers.
4. In the Year 3 'out' year, impetus to share and use WhatsApp as in previous years drops off for number of reasons.
5. Year 2 use of smart devices in college sessions is patchy and potentially underutilised. When they are used/allowed in class, it is usually to search the internet for information.
6. All use phones for academic assignments.
7. WhatsApp groups – extensive use in Y2, much less in Y3. Tutors, students, class reps.
8. In addition, the sharing culture appears to stop in and much lower priority- survival in the field highest priority.
9. Smart devices an alternative to expensive technologies and replacement for absence of any technologies in field. Students highly motivated to use them.

## Glossary

Basic Education	Primary School (6-12 years)
BERA	British Educational Research Association
CoE	College of Education
DBE	Diploma in Basic Education
HREC	Human Research Ethics Committee of the OU
ITT training	Initial Teacher Education, pre-service teacher
JHS	Junior High School (12-15/16 years)
MDGs	Millennium Development Goals
MoE	Ministry of Education (Ghana)
MOOC	Massive Online Open Course
OCTP	On Campus Teaching Practice
OER	Open Educational Resources
PTTR	Pupil Per Trained Teacher Ratio
SHS	Senior High School (15/16-18 years)
SSA	Sub Saharan Africa
SDGs	Sustainable Development Goals
TPD	Teacher Professional Development
TLMs	Teaching and Learning Materials
LWG	UK Literacy Working Group
UNCRC	United Convention of the Rights of the Child
UCC	University of Cape Coast, Ghana